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(Ervin A, Holtslander C, Qualman D, Sawa R, eds). Saskatoon, Saskatchewan:Canadian Centre for Policy Alternatives.

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Marion Deerhake et al., *Atmospheric Dispersion and Deposition of Ammonia Gas*, *in* RTI Int'l, Benefits of Adopting Environmentally Superior Swine Waste Management Technologies in North Carolina: An Environmental and Economic Assessment, at 2-32 to 2-34 (2003), *available at* http://www.cals.ncsu.edu/waste_mgt/smithfield_projects/phase1report04/appendix%20c-RTI.pdf, attached as **Exhibit 47** (modeling rates of ammonia deposition by county). "The greatest deposition occurs in Sampson and Duplin counties." *Id.* at 2-33.

Carrie Hribar, Nat'l Ass'n of Local Bds. of Health, *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities, Environmental Health* 4 (2010), *available at* http://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf, attached as **Exhibit 40**.

Maria C. Mirabelli et al., *Asthma Symptoms Among Adolescents Who Attend Public Schools That Are Located Near Confined Swine Feeding Operations*, 118 Pediatrics e66 (2006), attached as **Exhibit 42** (finding students aged 12 to 14 who attended North Carolina public schools within 3 miles of industrial swine facilities reported increased asthma-related symptoms, more doctor-diagnosed asthma, and more asthma-related medical visits compared to peers at other schools).

Maria C. Mirabelli et al., *Race, Poverty, and Potential Exposure of Middle-School Students to Air Emissions from Confined Swine Feeding Operations*, 114 Envtl. Health Perspectives 591, 595 (2006), attached as **Exhibit 43** (finding that North Carolina's swine facilities are located closer to schools enrolling higher percentages of non-white and economically disadvantaged students).

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Leah Schinasi et al., *Air Pollution, Lung Function, and Physical Symptoms in Communities Near Concentrated Swine Feeding Operations*, 22 Epidemiology 208, 208 (2011), attached as **Exhibit 48** (measuring pollutants levels and effect on 101 adults living near hog CAFOs in 16 eastern North Carolina communities).

Sacoby M. Wilson & Marc L. Serre, *Examination of Atmospheric Ammonia Levels Near Hog CAFOs, Homes, and Schools in Eastern North Carolina*, 41 Atmospheric Env't 4977, 4985 (2007), attached as **Exhibit 49**.

Steve Wing & Jill Johnston, Dep't of Epidemiology, Univ. of N.C. at Chapel Hill, *Industrial Hog Operations in North Carolina Disproportionately Impact People of Color* (2014) attached as **Exhibit 4.**

Steve Wing et al., *Air Pollution and Odor in Communities Near Industrial Swine Operations*, 116 Envtl. Health Perspectives 1362 (2008), attached as **Exhibit 50** (study participants living within 1.5 miles of swine factory farm reported altering or ceasing normal daily activities when hydrogen sulfide concentrations, and associated hog odor, were the highest) [Wing, *Air Pollution and Odor*].

Steve Wing et al., *Air Pollution from Industrial Swine Operations and Blood Pressure of Neighboring Residents*, 121 Envtl. Health Perspectives 92 (2013), attached as **Exhibit 51**.

Steve Wing et al., *Environmental Injustice in North Carolina's Hog Industry*, 108 Envtl. Health Perspectives 225, 228 (2000), attached as **Exhibit 52** [Wing, *Environmental Injustice*]. (finding that North Carolina's intensive hog confinement operations are located disproportionately in communities with higher levels of poverty, higher proportions of non-white persons, and higher dependence on wells for household water supply).

**Cited in Complaint, but copy not provided.**

Julia R. Barrett, *Airborne Bacteria in CAFOs: Transfer of Resistance from Animals to Humans*, 113 Envtl. Health Perspectives A116 (2005) (reviewing literature on cross-species transfer of antibiotic-resistant bacteria).

JoAnn M. Burkholder & Howard B. Glasgow, *History of Toxic Pfiesteria in North Carolina Estuaries from 1991 to the Present*, 51 Biosci. 827, 833 (2001) ("During acute [Pfiesteria] exposure, fish commonly hemorrhage or develop skin lesions that are diffuse or nonfocal, as well as deep, localized or focal, bleeding sores or ulcerations.").

Joan A. Casey, *High-Density Livestock Operations, Crop Field Application of Manure, and Risk of Community-Associated Methicillin-Resistant* Staphylococcus aureus *Infection in Pennsylvania*, 173 J. Am. Med Ass'n: Internal Med. 1980 (2013).

Ctrs. for Disease Control, U.S. Dep't of Health and Human Servs., Antibiotic Resistance Threats in the United States, 2013, at 6 (2013), *available at* http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf.

Amy Chapin et al., *Airborne Multidrug-Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation*, 113 Envtl. Health Perspectives 137 (2005) (finding multidrug-resistant *Enterococcus*, coagulase-negative staphylococci, and viridans group streptococci in the air of an industrial swine operation at levels dangerous to human health).

Jennifer K. Costanza et al., *Potential Geographic Distribution of Atmospheric Nitrogen Deposition from Intensive Livestock Production in North Carolina, USA*, 398 Sci. Total Env't 76, 77 (2008).

Jennifer K. Costanza et al., *Potential Geographic Distribution of Atmospheric Nitrogen Deposition from Intensive Livestock Production in North Carolina, USA*, 398 Sci. Total Env't 76, 77 (2008).

Oliver Denis et al., *Methicillin-Resistant* Staphylococcus aureus *ST398 in Swine Farm Personnel, Belgium*, 15 Emerging Infectious Diseases 1098 (2009) (Belgium).

B. Edwards B & AE Ladd, *Race, Poverty, Political Capacity and the Spatial Distribution of Swine Waste in North Carolina*, 1982–1997, 9 North Carolina Geogr 55–77 (2001).

Shawn G. Gibbs et al., *Airborne Antibiotic Resistant and Nonresistant Bacteria and Fungi Recovered from Two Swine Herd Confined Animal Feeding Operations*, 1 J. Occupational & Envtl. Hygiene 699 (2004) (finding multidrug-resistant bacteria inside and downwind of industrial swine operations at levels previously determined to pose a human health hazard).

Shawn G. Gibbs et al., *Isolation of Antibiotic-Resistant Bacteria from the Air Plume Downwind of a Swine Confined or Concentrated Animal Feeding Operation*, 114 Envtl. Health Perspectives 1032 (2006).

Michael Greger & Gowri Koneswaran, *The Public Health Impacts of Concentrated Animal Feeding Operations on Local Communities*, 33 Farm Cmty. Health 11, 13 (2010).

Joseph Herriges et al., *Living with Hogs in Iowa: The Impact of Livestock Facilities on Rural Residential Property Values*, 81 Land Econ. 530 (2005).

Carol J. Hodne, Iowa Policy Project, Concentrating on Clean Water: The Challenge of Concentrated Animal Feeding Operations 8 (2005), *available at* http://www.iowapolicyproject.org/2005docs/050406-cafo-fullx.pdf. 2005docs/050406-cafo-fullx.pdf (identifying "seepage from earthen manure storage structures" as typical pathway for nitrates entering groundwater).

Rachel Avery Horton et al., *Malodor as a Trigger of Stress and Negative Mood in Neighbors of Industrial Hog Operations*, 99 Am. J. Pub. Health Suppl., S610 (2009).

Xander W. Huijsdens et al., *Community-Acquired MRSA and Pig-Farming*, 5 Annals Clinical Microbiol. & Antimicrobials 26 (2006) (Netherlands).

T. Khanna et al., *Methicillin Resistant* Staphylococcus aureus *Colonization in Pigs and Pig Farmers*, 128 J. Veterinary Microbiol. 298 (2008) (Canada).

Jungik Kim & Peter Goldsmith, *A Spatial Hedonic Approach to Assess the Impact of Swine Production on Residential Property Values*, 42 Envtl & Res. Econ. 509 (2009) (estimating decline in Craven County home property values on per hog basis).

Michael A. Mallin et al., Ctr. for Marine Science Research, Univ. of N.C. at Wilmington, Effect of Organic and Inorganic Nutrient Loading on Photosynthetic and Heterotrophic Plankton Communities in Blackwater Rivers (1998), *available at* http://repository.lib.ncsu.edu/dr/bitstream/1840.4/1880/1/NC-WRRI-315.pdf; Michael A. Mallin et al., *Factors Contributing to Hypoxia in Rivers, Lakes, and Streams*, 51 Limnology & Oceanography 690, 699-700 (2006).

James A. Merchant et al., *Asthma and Farm Exposures in a Cohort of Rural Iowa Children*, 113 Envtl. Health Perspectives 350 (2005) (finding children living on swine farms, including large facilities with more than 500 head, experienced increased rates of asthma compared to non-exposed children; results more pronounced where swine facilities added antibiotics to feed).

Katherine Milla et al., *Evaluating the Effect of Proximity to Hog Farms on Residential Property Values: A GIS-Based Hedonic Model Approach*, 17 URISA J. 27 (2005) (finding that values of

Craven County, North Carolina homes decreased with increasing local hog populations and decreasing distances from homes to factory farms).

Katja Radon et_al., *Environmental Exposure to Confined Animal Feeding Operations and Respiratory Health of Neighboring Residents*,18 Epidemiology 300 (2007) (surveying nearly 7,000 residents of four German towns with high confined livestock operation densities and concluding that such operations "may contribute to the burden of respiratory disease among their neighbors"). (Footnoted in Earthjustice comments on draft permit).

C.A. Rotz, *Management to Reduce Nitrogen Losses in Animal Production*, 82 J. Animal Sci. E119, E129 (2004).

Ana M. Rule et al., *Assessment of an Aerosol Treatment To Improve Air Quality in a Swine Concentrated Animal Feeding Operation,* 39 Envtl. Sci. & Tech., 9649, 9649 (2005).

Jessica L. Rinsky et al., *Livestock-Associated Methicillin and Multidrug Resistant* Staphylococcus aureus *Is Present Among Industrial, Not Antibiotic-Free Livestock Operation Workers in North Carolina*, 8 PLoS One e67641 (2013).

Jochen Schulz et al., *Longitudinal Study of the Contamination of Air and of Soil Surfaces in the Vicinity of Pig Barns by Livestock-Associated Methicillin-Resistant* Staphylococcus aureus, 78 Applied Envtl. Microbiol. 5666 (2012) (detecting MRSA 300 feet from a barn in which animals, air, and workers' plastic boots tested positive for MRSA).

Susan S. Schiffman et al., *Quantification of Odors and Odorants from Swine Operations in North Carolina*, 108 Agric. & Forest Meteorology 213 (2001).

Susan S. Schiffman et al., *Symptomatic Effects of Exposure to Diluted Air Sampled from a Swine Confinement Atmosphere on Healthy Human Subjects*, 113 Envtl. Health Perspectives 567 (2005) (finding that those exposed to diluted swine air for two 1-hour sessions were more likely to report headaches, eye irritation, and nausea than the control group that was exposed to clean air); http://www.ncbi.nlm.nih.gov/pubmed/15866765.

Doug Gurian-Sherman, Union of Concerned Scientists, CAFOs Uncovered: The Untold Costs of Confined Animal Feeding Operations (2008), *available at* http://www.ucsusa.org/assets/documents/food_and_agriculture/cafos-uncovered.pdf (discussing the substantial cost of confined animal feeding operations and discussing alternatives).

EK Silbergeld & LB Price LB, *Industrial Food Animal Production, Antimicrobial Resistance, and Human Health*, 29 Ann. Rev. of Pub. Health 151 (2008).

Tara C. Smith et al., *Methicillin-Resistant* Staphylococcus auereus *(MRSA) Strain ST398 Is Present in Midwestern U.S. Swine and Swine Workers*, 4 PLoS One e4258 (2009).

Tara C. Smith et al., *Methicillin-Resistant* Staphylococcus aureus *in Pigs and Farm Workers on Conventional and Antibiotic-Free Swine Farms in the USA*, 8 PLoS One e63704 (2013).

Stacy Sneeringer, *Does Animal Feeding Operation Pollution Hurt Public Health? A National Longitudinal Study of Health Externalities Identified by Geographic Shifts in Livestock Production*, 91 Am. J. Agric. Econ. 124, 130 (2009).

Paul B. Stretesky et al., *Environmental Inequity: An Analysis of Large-Scale Hog Operations in 17 States, 1982-1997*, 68 Rural Soc. 231 (2003) (finding that between 1982 and 1997 large-scale hog operations in North Carolina were more likely to be sited in areas with a disproportionate number of black residents).

K.M. Thu, *Public Health Concerns for Neighbors of Large-Scale Swine Production Operations*, 8 J. Agric. Safety & Health 175 (2002) (synthesizing research regarding public health concerns for neighbors of industrial swine facilities, including respiratory issues associated with air pollution).

Ingrid V.F. Van den Broek et al., *Methicillin-Resistant* Staphylococcus aureus *in People Living and Working in Pig Farms*, 137 J. Epidem. & Infection 700 (2009) (Netherlands).

Matias B. Vanotti & Patrick G. Hunt, Ammonia Removal from Swine Wastewater Using Immobilized Nitrifiers, *in* Proceedings of the 8th Int'l. Conf. of the FAO ESCORENA Network on Recycling of Agricultural, Municipal and Industrial Residues in Agriculture, Rennes, France 427, 428 (1998), *available at* http://www.ramiran.net/doc98/FIN-ORAL/VANOTTI.pdf.
James A. Zahn et al., *Air Pollution from Swine Production Facilities Differing in Waste Management Practice* 3, Proceedings of the Odors and Emission 2000 Conference (2000) (listing all types of "emissions released from stored swine manure" mentioned above).

John T. Walker et al., *Atmospheric Transport and Wet Deposition of Ammonium in North Carolina*, 34 Atmospheric Env't 3,407 (2000).

Steve Wing, et al., *The Potential Impact of Flooding on Confined Animal Feeding Operations in Eastern North Carolina*, 110 Envtl. Health Perspectives 387, 387 (2002), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1240801/pdf/ehp0110-000387.pdf (describing how the 15-20 inches of rain dropped by Hurricane Floyd turned eastern North Carolina into a fecal flood zone). The flooding following Hurricane Floyd was not an isolated incident. *Id.* ("In 1996, 22 fecal waste pits were reported to have been ruptured or inundated following flooding from Hurricane Fran, and one major spill was reported following Hurricane Bonnie in 1998.").

Wing S. 2002. *Social Responsibility and Research Ethics in Community-Driven Studies of Industrialized Hog Production. Environ*. Health Perspect. 110:437–444.

Wing S, Freedman S, Band L. 2002. *The Potential Impact of Flooding on Confined Animal Feeding Operations in Eastern North Carolina*. Environ. Health Perspect. 110:387-391.

Wing S, Horton RA, Marshall SW, Thu K, Tajik M, Schinasi L, et al. 2008. *Air Pollution and Odor in Communities Near Industrial Swine Operations.* Environ. Health Perspect. 116:1362-1368.

Bridgett M. West et al., *Antibiotic Resistance, Gene Transfer, and Water Quality Patterns Observed in Waterways Near CAFO Farms and Wastewater Treatment Facilities*, 217 Water Air Soil Pollution 473 (2011).

Sacoby M. Wilson & Marc L. Serre, *Use of Passive Samplers to Measure Atmospheric Ammonia Levels in a High-density Industrial Hog Farm Area of Eastern North Carolina*, 41 Atmospheric Env't 6,074 (2007).

**Studies not listed above Earthjustice cited in their 2013 comments on draft Swine Permit**

Rachel Avery et al., *Odor from Industrial Hog Farming Operations and Mucosal Immune Function in Neighbors*, 59(2) Archives of Envtl. Health 101 (2004) (finding that swine odor was associated with reduced mucosal immune function among 15 adults living near industrial swine operations in North Carolina).

J.M. Ham & K.A. Baum, *Measuring Seepage from Waste Lagoons and Earthen Basins with an Overnight Water Balance Test*, 52 Am. Soc'y of Agric. And Biological Engineers 835 (2009) (introducing test capable of producing accurate seepage measurements in single overnight performance).

J.M. Ham, *Seepage losses from animal waste lagoons: A summary of a four year investigation in Kansas*, 45 Am. Soc'y of Agric. Eng'rs 983 (2002) (summarizing study performed using earlier variation of water balance method).

**Studies not listed above cited in Exhibit 4 (**Steve Wing & Jill Johnston, Dep't of Epidemiology, Univ. of N.C. at Chapel Hill, *Industrial Hog Operations in North Carolina Disproportionately Impact People of Color* (2014)).

Bullers S. 2005. *Environmental Stressors, Perceived Control, and Health: The Case of ResidentsNear Large-Scale Hog Farms in Eastern North Carolina*. Human Ecology 33:1-16.

Casey JA, Curriero FC, Cosgrove SE, Nachman KE, Schwartz BS. 2013. *High-Density Livestock Operations, Crop Field Application of Manure, and Risk of Community-Associated Methicillin-Resistant Staphylococcus Aureus Infection in Pennsylvania*. JAMA Internal Medicine 173:1980-1990.

Cole D, Drum DJ, Stalknecht DE, White DG, Lee MD, Ayers S, et al. 2005. *Free-living Canada Geese and Antimicrobial Resistance*. Emerging Infectious Diseases 11:935-938.

Donham K. 1993. *Respiratory Disease Hazards to Workers in Livestock and Poultry*

*Confinement Structures*. Seminars in Respiratory Medicine 14:49-59.

Donham K, Reynolds S, Whitten P, Merchant J, Burmeister L, Popendorf W. 1995. *Respiratory Dysfunction in Swine Production Facility Workers: Dose-response Relationships of Environmental Exposures and Pulmonary Function*. American Journal of Industrial Medicine 27:405-418.

Donham K, Cumro D, Reynolds S, Merchant J. 2000. *Dose-Response Relationships Between Occupational Aerosol Exposures and Cross-Shift Declines of Lung Function in Poultry Workers: Recommendations for Exposure Limits*. Journal of Occupational and Environmental Medicine 42:260-269.

Donham KJ. 1990. *Health Effects from Work in Swine Confinement Buildings*. American Journal of Industrial Medicine 17:17-25.

Donham KJ, Wing S, Osterberg D, Flora JL, Hodne C, Thu KM, et al. 2007. *Community Health and Socioeconomic Issues Surrounding Concentrated Animal Feeding Operations*. Environ. Health Perspect. 115:317-320.

Furuseth O. 1997. *Restructuring of Hog Farming in North Carolina: Explosion and Implosion*. Professional Geographer 49:391-403.

Graham JP, Price LB, Evans SL, Graczyk TK, Silbergeld EK. 2009. *Antibiotic Resistant Enterococci and Staphylococci Isolated from Flies Collected near Confined Poultry Feeding Operations*. Sci Total Environ 407:2701-10.

Green CF, Gibbs SG, Tarwater PM, Mota LC, Scarpino PV. 2006. *Bacterial Plume Emanating from the Air Surrounding Swine Confinement Operations*. Journal of Occupational and Environmental Hygiene 3:9-15.

Rinsky JL, Nadimpalli M, Wing S, Hall D, Baron D, Price LB, et al. 2013. *Livestock-Associated Methicillin and Multidrug Resistant Staphylococcus Aureus Is Present Among Industrial, Not Antibiotic-Free Livestock Operation Workers in North Carolina*. PloS One 8:e67641.

Schiffman SS, Sattely Miller EA, Suggs MS, Graham BG. 1995. *The Effect of Environmental Odors Emanating from Commercial Swine Operations on the Mood of Nearby Residents*. Brain Research Bulletin 17:369-375.

Tajik M, Muhammad N, Lowman A, Thu K, Wing S, Grant G. 2008. *Impact of Odor from Industrial Hog Operations on Daily Living Activities.* New Solututions 18:193-205.

Thu K, Donham K, Ziegenhorn R, Reynolds S, Thorne P, Subramanian P, et al. 1997. *A Control Study of the Physical and Mental Health of Residents Living near a Large-Scale Swine Operation*. Journal of Agricultural Safety and Health 3:13-26.

Thu K. 2001. *Agriculture, the Environment, and Sources of State Ideology and Power*. Culture and Agriculture 23:1-7.

Thu K. 2003. *Industrial Agriculture, Democracy, and the Future. In: Beyond Factory Farming: Corporate Hog Barns and the Threat to Public Health, the Evironment, and Rural Communities*, (Ervin A, Holtslander C, Qualman D, Sawa R, eds). Saskatoon, Saskatchewan:Canadian Centre for Policy Alternatives.

van de Giessen AW, van Santen-Verheuvel MG, Hengeveld PD, Bosch T, Broens EM, Reusken CB. 2009. *Occurrence of Methicillin-Resistant Staphylococcus Aureus in Rats Living on Pig Farms*. Preventive Veterinary Medicine 91:270-273.

**Other studies I came across**

Yelena Ogneva-Himmelberger *, Liyao Huang and Hao Xin, *CALPUFF and CAFOs: Air Pollution Modeling and Environmental Justice Analysis in the North Carolina Hog Industry,* ISPRS Int. J. Geo-Inf. 2015, 4, 150-171; doi:10.3390/ijgi4010150 (Published: 26 January 2015)

**Abstract:** Concentrated animal feeding operations (CAFOs) produce large amounts of animal waste, which potentially pollutes air, soil and water and affects human health if not appropriately managed. This study uses meteorological and CAFO data and applies an air pollution dispersion model (CALPUFF) to estimate ammonia concentrations at locations downwind of hog CAFOs and to evaluate the disproportionate exposure of children, elderly, whites and minorities to the pollutant. Ammonia is one of the gases emitted by swine CAFOs and could affect human health. Local indicator of spatial autocorrelation (LISA) analysis uses census block demographic data to identify hot spots where both ammonia concentrations and the number of exposed vulnerable population are high. We limit our analysis to one watershed in North Carolina and compare environmental justice issues between 2000 and 2010. Our results show that the average ammonia concentrations in hot spots for 2000 and 2010 were 2.5–3-times higher than the average concentration in the entire watershed. The number of people living in the areas where ammonia concentrations exceeded the minimal risk level was 3647 people in 2000 and 3360 people in 2010. We recommend using air pollution dispersion models in future environmental justice studies to assess the impacts of the CAFOs and to address concerns regarding the health and quality of life of vulnerable populations.

Donham KJ1, Lee JA, Thu K, Reynolds SJ., *Assessment of air quality at neighbor residences in the vicinity of swine production facilities*., J Agromedicine. 2006;11(3-4):15-24. doi: 10.1300/J096v11n03_03. http://www.ncbi.nlm.nih.gov/pubmed/19274894

**Abstract:** Air sampling was completed on the front lawn of 35 homes neighboring swine farms in three different regions in the Upper Midwest of the United States. One region was dominated by large scale, swine confined animal feeding operations (CAFO's) noted as swine confinement area (SCA). The second area was dominated by smaller scale operations utilizing hoop structure facilities (HA). The third area was basically devoid of livestock, dominated by row-crop

production, and served as the control area (CA). The time weighted average concentrations of hydrogen sulfide (8.42 ppb) was higher (p = 0.047) in SCA area than the control (3.48 ppb). However, carbon dioxide (449.6 ppm), ammonia (12.78 ppb) and PM10 (42.25 microg/m3) were higher in the hoop structure area than the other areas. Swine population density, distance between the homes and swine facilities, and wind direction had an interactive effect on the average levels of ammonia (p = 0.04). The contaminant levels at the homes were relatively low compared to typical concentrations inside animal buildings. However, exceedences of federal recommended limits for hydrogen sulfide in outdoor air were observed in the swine CAFO area. Concentration of hydrogen sulfide exceeded the recommended limits of the ATSDR (30 ppb) for chronic exposure at two of the 12 homes in the CAFO area (17%). Average hydrogen sulfide concentration exceeded the EPA recommended community standards (0.7 ppb) in all three areas assessed (SCA, HA, and CA). As chronic exposure to hydrogen sulfide may be present in areas of production agriculture, a potential health risk may be present. Further studies to provide additional information regarding exposures to hydrogen sulfide in rural environments are warranted.

Thorne PS, Ansley AC, Perry SS. *Concentrations of bioaerosols, odors, and hydrogen sulfide inside and downwind from two types of swine livestock operations*. J Occup Environ Hyg. 2009 Apr;6(4):211-20. doi: 10.1080/15459620902729184
http://www.ncbi.nlm.nih.gov/pubmed/19177273

**Abstract:** Few data on in-barn and downwind concentrations of endotoxin, bioaerosols, and odors from livestock facilities are available, and no studies have compared conventional confinement operations with the more animal-friendly hoop operations. Hoops are open to the environment and use a composted bedding system rather than housing pigs on slatted floors over pits holding manure slurry as in conventional confinements. We assessed airborne toxicants upwind, in barns, and downwind and evaluated determinants of exposure. Inhalable particulate matter, endotoxin, odor threshold, hydrogen sulfide, culturable mesophilic bacteria, culturable fungi, and total airborne microbes, along with wind speed, temperature, and humidity were measured at separate midsized livestock facilities (one hoop, one confinement) in Central Iowa on 10 occasions over 2 years. Significant differences in contaminants were observed between hoops and confinement buildings and across seasons for endotoxin, odors, airborne microorganisms, and hydrogen sulfide. For hoops and confinements, respectively, geometric mean in-barn concentrations were 3250 and 3100 EU/m(3) for endotoxin; 1400 and 1910 microg/m(3) for particulates; 19.6 and 146 ppb for hydrogen sulfide; 137 and 428 dilutions for odor threshold; and 3.0 x 10(6) and 1.5 x 10(6) organisms/m(3) for total microbes. Endotoxin, odor, and culturable microorganisms exceeded recommended exposure limits. Reduced analysis of variance models for these contaminants demonstrated differences by barn type, season, number of pigs, and, in some cases, temperature and humidity. Both types of swine operations produced high airborne concentrations of endotoxin, odor, hydrogen sulfide, bacteria, and fungi. Endotoxin and odors were found downwind at concentrations previously associated with adverse health effects.

**See also:**

OW's July 2013 "*Literature Review of Contaminants in Livestock and Poultry Manure and Implications for Water Quality*" http://www.agcensus.usda.gov/publications/2007/full report/usvi.pdf.

Bill Schrock's zip file Appendix G (convert from WPD first) for swine references regarding pre-2002 studies on CAFOs and air issues.

**EPA**

**Moderator: Jonathan Stein**
**May 12, 2016**
**11:05 a .m. ET**

Operator: This is Conference #160552132

Conference record has joined the conference.

Female: Hello?

(Jill Johnston): Hello. This is (Jill Johnston).

Female: Hi (Dr. Johnston). Is Marianne on the line yet?

Mariane Engelman Lado: OK, you know what? We were mute. My apologies. So this is Mariane Engelman Lado from Earthjustice and I'm here with three colleagues and I'll let them introduce themselves.

Alexis Andiman: This is Alexis Andiman, also Earthjustice.

Brent Ducharme: Brent Ducharme from the UNC Center for Civil Rights.

Elizabeth Haddix: And Elizabeth Haddix, also from the Center for Civil Rights.

Female: Hi there. Who's there at EPA?

Ericka Farrell: OK. We got Ericka Farrell from OCR Title VI Office.

Jeryl Covington: Jeryl Covington from OCR Title VI Office.

Mary O'Loan: This is Mary O'Loan. I'm from the Office of General Counsel.

(Johanna Johnson): Hi. This is (Johanna Johnson) also from the Officer of General Counsel.

Ericka Farrell: Hi there. Thank you. OK. Good afternoon. Again, this is Ericka Farrell from the Office of Civil Rights Environmental Protection Agency in Washington, D.C. and thank you for taking the time to talk with us. And please be aware that this interview Dr. (Jill Johnston) is being recorded. And, are there any objections to recording this interview?

(Jill Johnston): No.

Female: Dr. Johnston, do you have any objections.

(Jill Johnston): No I guess.

Ericka Farrell: OK. Thank you. And as you know, your August 2014 study was submitted to OCR to alive (upon) in this investigation. And so whether North Carolina, Department of Environmental Quality Regulations that's (might) bidding operations, discriminate against African-Americans, Latinos, and Native Americans on the basis of race and national origin in neighboring counties and violation of Title VI and EPAs implementing regulations.

And today we plan to ask some – ask you some fundamental question. I'm sorry, foundational questions, regarding the study in order for the OCR to determine whether we can rely on this study for our investigation. And in doing so, we are trying to understand what issues and arguments may be raise in opposition to your study. And we may need to ask you further questions at a later date.

And as we get started, we're going to start right now, Dr. Johnston with just some basic background questions. And can you please state with the record your name.

Mariane Engelman Lado: I'm sorry. Ericka – Ericka, if I can just interrupt you for a second. I just want to make sure, there were two studies that Dr. (Wayne) and Dr. Johnston did conducted and then we submitted. One was the 2014 which you mentioned and the other was the revise version that's dated that it was exhibit 12 to submission earlier this year. And it was dated October 19th, 2015 and it's based on that current set of (hub) facilities that are under the general (permit). I just want to make sure both are in front of you.

Mary O'Loan: Well Marianne, the other one is not. The second only update. That's going to be one of our question. I'm sorry. This is Mary O'Loan. That was going to be one of our questions. Jeryl is now looking to see if we have it in our record.

(Gerald Cadington): Right. As if Exhibit 12, that's the decoration b **Personal Privacy / Ex. 6**

(Jill Johnston): No. She sent on something –

Ericka Farrell: So Jeryl, is not Exhibit 12 to the complaint. It's attachment 12 to a subsequent submission that we made in 2016 that contains (Steve Lings) declaration and it contains the revision of the study.

Mary O'Loan: What's the date of that because they're think – this is Mary again.

(Jill Johnston): OK.

Mariane Engelman Lado: They're faking their head like OCR doesn't have it. April as well as, you did received it. I'm certain of that. April 12, 2016. And it had – and this is attachment 12. And it's important, you know, that we'll get into the methodologies and all that.

But you know, we wanted to make sure that there was a study of the actual data under the new permit. And these provide study is based on that, the data under the new permit.

(Jill Johnston): OK.

Mariane Engelman Lado: And we should go ahead even if you can't find it, you can ask questions based on the first study and we can resume it another time. That will still be helpful I'm sure. But it's important that you have that second study.

Mary O'Loan: (Marianne) – this is Mary again. Are you at your desk? I mean can e-mail it to Jeryl?

Mariane Engelman Lado: Yes. E-mail it to all of us so that at least we know we have it. They'll go back and look for it. But I just want to make sure that we do get it today.

Ericka Farrell: But I also agree with you. Because I think methodology change from the report submitted with the complaint today. The questions would be the same. It's just a matter of the conclusions and results, right? That's what would have change potentially.

Mariane Engelman Lado: That's right. I mean, I'll let Dr. Johnston speak and she'll answer specific questions about that. But the basic methodology is the same – there was – there may have been some twits that when you focused on it, she can answer questions about. So Alexis is forwarding it and – who's – so who's going to – if they look for an e-mail who would it be from?

Alexis Andiman: (There's) just one e-mail I can send it to you and I'll just forward it to you right now.

Mariane Engelman Lado: Who should we send that for?

Alexis Andiman: Covington.jeryl.

Mariane Engelman Lado: OK. Got that.

Alexis Andiman: @epa.gov.

Mariane Engelman Lado: We do not – yes, we do not received that. I don't have a copy of that.

Female: Hi. So back to the beginning.

Ericka Farrell: Yes. For the record, Dr. Johnston, can you please provide your full name?

(Jill Johnston): Jill Elizabeth Johnston.

Ericka Farrell: And please provider your professional contact information specifically. Your office address and office telephone number and office e-mail.

(Jill Johnston): Yes. It's 2001 North Soto Street, Los Angeles, California 90089. My office phone number is 323-442-1099 and my e-mail is jillj@usc.edu.

Ericka Farrell: Thank you. And as we begin, can you also state what your current professional position is?

(Jill Johnston): An Assistant Professor of Preventive Medicine in the Division of Environmental Health at the University of Southern California.

Ericka Farrell: OK. And as we begin, also, can you give us what your professional background is in relation to the studies that we're going to be talking about today.

(Jill Johnston): Yes. I have a PhD in Environmental Science and Engineering with the minor and public policy from the University of North Carolina at Chapel Hill and also completed a Post Doctoral Fellowship and Environmental Epidemiology also at UNC.

Ericka Farrell: OK. And now, I'm going to (time) this over to Mary.

Mary O'Loan: This is Mary O'Loan. Dr. Johnston, Marianne's probably explain to you one of the reasons that we wanted to speak with you. And after we go through the questions that we have, you can see why it was very good idea for us to speak

to you first. Because what we wanted to do when Marianne explain that Personal Privacy / Ex. 6 Personal Privacy / Ex. 6 that you know, if we had a chance to speak with him in the future, we wanted to try to limit the questions that you know, we would you know, we would be asking him.

So, we really appreciate you taking yourself available to answer these questions with us. Because I think, there a lot of them and a lot it explain from the fact that don't have a particular background on this. So, we're going to ask you probably some very basic questions from your perspective.

(Jill Johnston): OK.

Mary O'Loan: But the first one is your role in the – we're going to talk first about the 2014 study. And your role in that study.

(Jill Johnston): Yes, so I collected the data and conducted the analysis and consultation with Dr. (Ling) and created that the table and figures n this report and help with drafting the tax. But Dr. (Ling) had the lead on writing the text for this.

Mary O'Loan: OK. With this study peer reviews or did it go through any kind of even in the formal internal sort of peer review?

(Jill Johnston): There was discussion with other faculty within our department at University of North Carolina but it was not submitted or considered under scientific peer review process for our journal.

Mary O'Loan: OK. And we might as well ask the update that was done. Is it similar?

(Jill Johnston): Yes, (inaudible) often not submitted or has been under a scientific peer review.

Mary O'Loan: OK. Do you – and Marianne I don't know if this is – this is may be a question for you. I don't know if it's for you or Dr. Johnston but was the – was the 2014 study submitted to North Carolina DEQ?

(Jill Johnston): No.

Mary O'Loan: OK. Or do you know if they're aware of it?

(Jill Johnston): Not to my knowledge.

Mary O'Loan: OK. All right. Now we're going to get into sort of a knots and bolts of the questions that we had about the study itself. So, Dr. Johnston, do you know – can you explain why three miles was chosen as the distance?

(Jill Johnston): Yes, so we based that on a few (pay existing) peer reviewed scientific studies. One is by Personal Privacy / Ex. 6 from 2006 that specifically looked at asthma prevalent in Medical school students in North Carolina and found that medicals are there a few mile (radius) of an industrial hub operation had higher prevalent of asthma, another asthma related symptoms, some type of students who went to school further away.

Also some (dispersion) modeling of hydrogen sulfide conducted of a large (hub case) in Iowa show that hydrogen sulfide can travel up to this 6 kilometers which is a little three miles from the facility itself and impact (air) quality in that radius. And there was also sort of two other studies that looked at, the relationship between hydrogen sulfide protections and (inaudible) one from North Carolina and one from Iowa.

The one from North Carolina being by (Getry) in 2016 and then by (inaudible) in 2013 that used 5 kilometers as their distance.

Mary O'Loan: OK. Thanks. Did you by any chance look at other distances or analyze other distances that weren't discussed in the 2014 report.

(Jill Johnston): Yes. So we did not. We considered different criteria for inclusion of senses blocks, you know, whether any part was within three miles or whether they're (centroid). But we didn't have a capacity that compare our three mile results to two miles or one mile or refresh some other criteria.

Mary O'Loan: OK. How was – so (there's) the question. How is the (block centroid) determined? Was it be graphic, vocation or?

(Jill Johnston): Yes. So it's within our GIS software with you know, the sentence lock data from the U.S. and to 2010. And then, yes, the program assigned the (centroid).

Mary O'Loan: So it assigned that based on the geographic center of the block not something to do with the population.

(Jill Johnston): It had nothing to do with population, yes. It had to do with what's (facial) definition of where the (centroid) would be based on the shape of the block.

Mary O'Loan: OK. For the study area, 19 counties were excluded that didn't have an IHO and didn't boarder one. Why was it important to exclude those 19?

(Jill Johnston): We thought it's appropriate to consider population that were potentially at risk for being near an industrial hub operation. And so, just the geography and (mountainous) nature of Western North Carolina, you know, as well as highly urbanized areas. Or just not locations where (capos) would be sided. So we didn't consider those population at risk and that did not include them in the study area for this analysis.

Jeryl Covington: Yes. This is Jeryl Covington. You do have one question on that one. You all were also excluding the counties that were adjacent to and had no – please give – can you explain the basis for that exclusion as well to the 19th county in the Western North Carolina area.

(Jill Johnston): So it's with the counties where they had any two criteria. One is they had no (capo) in that border and no adjacent county for them had any (capo). And it's largely because these areas are highly mountainous and don't have the facilities or that the land maps that you need for the liquid waste distribution system. For a (capo) to be permitted there.

Jeryl Covington: OK. All right.

Mary O'Loan: This is Mary again. What is the – can you explain the adjustment for morality and is that the same thing as adjusting for population density. And then why was that appropriate?

(Jill Johnston): Yes. So – yes. The – so the content of reality we measured it by population density for each (inaudible) block. And we find this – and so we present those to unadjusted and the adjusted values in the report. But find that this is important because the land availability and also typically the price of land is highly influence by the population density in the amount of land that is available.

And also different (inaudible) of which racial or ethnic group within which areas can be – can influence population density as well. So that's why we – we chose that content of both the marker of kind of the economics and the land availability to adjust for in the model.

Jeryl Covington: This is Jeryl again, could you – could you clarify the land availability. I wasn't quite clear on that explanation.

(Jill Johnston): OK. Yes, so, I mean. As I mentioned before, now do you need the barns to how is the animals but then also you know, field around it where the waste that's spray. So an area with the high population density, you're not going to have – it's not necessarily going to be appropriate to have the space availability to put a (capo) on those areas or to put as many.

And I sort of – it's basically, you know, the land available for agriculture can basically correlated with the population density of that area.

Mary O'Loan: But that was – OK. This is Mary again. Because I – you can't see me but my brain is cranking very slowly. But, so this is not because you were excluding these areas because you've already excluded the 19 counties that have nothing. Now you're doing an adjustment to say, to basically say that OK, in the – to find that the (sparsely) populate – maybe we'll get into when we get back into the table in explaining those. But I'm trying to understand that the fundamental points of why you did it.

And it is to say that these things tend to go in really rural areas. And you know, as we look at areas to get more and more rural, we also see, you know, where they are. The amounts of (inaudible) there are and a change in the demographics. That's why you're doing the morality piece to it?

(Jill Johnston): Yes. And it's sort of a contact of, I guess they're familiar with confounding and other epidemiological model. So we felt that population density is a very important factor that influences deciding of (inaudible) (capos). And so, that's why we presented sort of adopted models to acknowledge that fact that population density and sort of a proxy for both the cost of land and the, sort of amount of land that would be available for either cultural activity was important to consider when we're looking at the association between race and committing of how (capos).

Mariane Engelman Lado: This is Marianne. Can I jump in for a sec. Stage 4 of the 2014 reports. Dr. Johnston, you have – if there's a sentence there that says, by adjusting for populations density or morality, we compare racial vulnerability that IHOs for racial groups within each level of morality to –

(Jill Johnston): Right.

Mariane Engelman Lado: I think that's what you're getting at. Can you explain that a little bit more that is – so it's not taking away the family ins of (racist) testing for it by looking within each level were up. Or I can even say the word, morality. Is there still salience of race towards this outcome?

(Jill Johnston): That is correct and we try to provide and example here that perhaps a little bit more intuitive. But for example, like when you're looking at mortality rate and you want to compare across two populations. It's important to account for age because of risk of mortality changes with different age groups.

And so at the age structure of the two populations aren't equal, you want to address for those factors or account for those factors so that you can look with any to age group. So essentially, we're trying to account for the same thing

here that is not (inaudible) that perhaps your risk for a (capo) being permitted nearby. You – is different depending on the population density of the area where you leave.

And so by including that adjustment, we can account for those differences across different areas in North Carolina.

Mariane Engelman Lado: OK. Is everybody good on that right now? OK.

Mary O'Loan: OK. Can you explain the study state live weight calculation? So we're on page 4 again of the 2014 study. And how did you determine whether the study state live weight of an IHO should be included and I – this is – it's not about the calculation of the city state live weight but more – how you captured a particular IHO. And I sort to have two visual images in my mind. And one has – you take the (centroid) of a block. And you draw a circle three miles out, right?

(Jill Johnston): OK.

Mary O'Loan: This is what I'm thinking happened. And the latitude and longitude of any IHO that still within that three mile circle is what you counted. Is that right?

(Jill Johnston): Correct. And it was some, but yes. We started the (centroid) of each block. And did exactly what you describe.

Mary O'Loan: Because, well we were trying to figure out whether there was anything – whether it was like if you had, instead you were pulling. If there were a block that (startle) the three mile circle, you know, you would pull an IHO that might be sitting in that block. Do you know what I mean? But that's not what you did. You just – it was if the latitude and longitude of that (cape) of fit in the circle. Then it was added to the total weight.

(Jill Johnston): Yes. So in essence, each (capo) was not counted one time. It could be counted multiple times depending on how many blocks it was within three miles from.

Mariane Engelman Lado: This is Mariane Engelman Lado again. Dr. Johnston, if there was a (capo) that startled those that three mile radius or within one radius and another radius, how would you handle it?

(Jill Johnston): Yes. So we were reading on analysis is the sense of block. And so for each senses block sort of independent or the other ones, we would draw to three mile radius and count up every (capo) that sell within the three miles. And then we would go to the next, you know, the adjacent block to it. Draw a circle in count of every (capo) within three miles of that block.

And so, the son of the (stead) state live weight, could be counted, you know, if not, we didn't assigned each (capo) only to one block. Reassign each block to the nearby (capos). Either that help explain it?

Mariane Engelman Lado: I think so.

Mary O'Loan: Well, so then the next, I guess my next question is when you look at the people. So the latitude and longitude has to be within third, three mile circle. And then when you count the people, how are you doing that?

(Jill Johnston): So the people aren't counted more than once. We include the population of each fences block. So, all the – there are the hundred people living in the senses block. They're all assigned the same study state live weight based on what the three mile radius.

Mary O'Loan: OK. OK.

(Jill Johnston): So people are not counted more than once in the model.

Mary O'Loan: OK. I get it. Anybody else have any question about study state live weight? All right.

OK, the next question was about you know, asking you about the update. Did the update happened but we know that it did. So, we will skip that one and come back to it at a later date probably.

(Jill Johnston): OK.

Mary O'Loan: So on page 4, you describe how rate in ethnicity was categorized. But then when we look at the complaint, we went – and we look at page – where is that? 106. 106.

OK, on page – I don't know what – 35 of the complaint. It also talks about the characterization in particular of African-Americans. And the description seemed inconsistent to us. And it had to do with (inaudible) people who could identify themselves as black and Hispanic.

And so, we were wondering if these two – if the state (meant) about it on page 4 of the 2014 report and put note 106 on page 35 of the complaint, whether they were inconsistent or weren't inconsistent or you know, like how we should be interpreting this.

(Jill Johnston): I mean, so I can describe the definition we used in the report and then maybe Marianne can talk about the footnote. But we used sort of one other fences category. And so, our definition of block was anyone who identified it – identify themselves as African-Americans are black list or without any other race or ethnicity.

So if they identified as black and Hispanic, it would be categorized in this black group. So that's how we did it for the purposes of this –

Mary O'Loan: OK. I'm sorry Dr. Johnston in – on page four it says black. It's people who identify themselves as African American or Black with or without any other race. Is that right? I thought just heard only without – with.

(Jill Johnston): Yes.

Mary O'Loan: I'm sorry without.

(Jill Johnston): No, I'm sorry for the fact that I misstated. No, I meant – yes, (inaudible) written here is correct. So it's –

Mary O'Loan: And then footnote 106 says the term African American here in core sponsors turn black as used in the report it – the black racial category referred to those who identified as African American – that's probably a typo. It should be with or without.

(Jill Johnston): OK, all right.

(Johanna Johnson): Hi this is (Johanna Johnson). I just one quick follow up question. And that's with regards to individual to identify themselves as Black Hispanic. You indicated they will be categorized in the black category. But would they also appear in the Hispanic category as well?

(Jill Johnston): Yes, So I would note one of the table these terms but the definitions of Black, Hispanic and America Indian. We do not use mutually exclusive terms or mutually exclusive categories. So people when we do the race specific analysis they could be counted with more than one race based on what they identified on their (inaudible) forms.

Mary O'Loan: OK, any other –

(Jill Johnston): But the category of non Hispanic white and people of color. Those are mutually exclusive. So there's no one that overlap, you know, which is what we use for our primary analysis.

Mary O'Loan: Right. Anything else?

(Johanna Johnson): No.

Mary O'Loan: OK. Now what we'd like to and (Mary Anne) maybe you can help in the updates that was (inaudible). You know is it just the numbers that have changed? Well let me explain what I'm going to do here.

What we wanted to do was walk through in a study. Each of the tables – each of the figures and table to make sure we understand what they say. and then we wanted to look at them – look at how they're characterized in the complaint because one of the things that we have to do as discussed it internally is be able to communicate in layman's terms how these – what these findings are. So we want to make sure that we understand it and we can see that, you know, the complaint takes, you know, right up something.

And so we wanted to see – we wanted to make sure that, you know, within study or I mean what within the complaint could, you know, use that as our layman's discussions. That we wanted to cross walk these things but also go through them and make sure that we actually understand, you know, what the study itself is saying. OK.

Mariane Engelman Lado: Yes, let me give some context and I don't know if this will be helpful or not but let's try. First of all Elizabeth reminded me and we will double check. When we filled the complaint we probably sent a copy to (Inaudible) are now DEQ.

There were some confidential documents in there. So we didn't send the whole thing. And we'll have to go back and check our records and let you know what we sent and what we didn't. I don't see any reason – I mean this was not a confidential document. But I just don't remember.

So and I'm not sitting in front of the, you know, my computer where I can pull up exactly what was sent to DEQ. So we'll do that and we'll get back to you on that. In terms of the difference let me tell you our thinking and methodology as complainants. And then Dr. Johnston can say a little bit about what might have been different if you remember Dr. Johnston.

So we obviously wanted to get even though the 180 day requirement is waivable we wanted to get a complete set of allegations into OCR within 180 days. So we wanted to do – just a submit a disproportionality analysis that was rigorous within that 180 day timeline. The challenge is the 180 day timeline the data – I think it wasn't even up on the Website for DEQ then DNR. But it was and not with sufficient notice to be able to ask Dr. (Ling) and Dr. Johnston to do an analysis.

So talking to – knowing that there wasn't going to be that much difference in the location of these facilities for technical reasons which you maybe aware of that any new facility in the State of North Carolina have to use new technologies. And it's only pre-existing facilities that haven't expanded that under the state the general permit. So while some facilities may drop out of the list there are not going to be any new facilities on the list.

And there's kind of disincentive to drop out. So we knew there wouldn't be that much change. So we did ask Dr. (Ling) and Dr. Johnston if it made sense to do the disparities analysis first on the list that existed at the time right before we filed the complaint which is what they did with the – and then and they could refine their methodology by doing that building on the work that they had previously done on disproportionality.

And then once – once we had the list and I should say and Dr. Johnston you can talk more about this. There was a lot of work that went into that. There was a lot of clean up of the data. The – the geographic locations often weren't right.

There was just a lot of work that went into working with that list. And then they were able to provide the 2014 disproportionality analysis. But with the full intent that once we had the – the list of facilities that had been approved for operation under the challenge firm and are under the new permit they would then conduct the same analysis.

But I say the same kind of in quotes because if there were any – any lessons learned or any tweaks that the new data provided that they would – they were

free to kind of have the best analysis possible. So, you know, again Dr. Johnston can refresh my memory to precisely what tweaks there may have been. But I don't want to state that the only difference is in the results because there was an opportunity to have a fresh look at the methodology – fundamentally the methodology was similar. But they were able to tweak the way they were doing things in order to do the best study possible.

(Jill Johnston): Yes, so the major difference is there were 2,055 cases included in the 2014 analysis. And then for the updated analysis based on the permit list there were 2029. So, you know, that was a major change for facilities that do not undergo permitting or ones that where their permit expired and we do have any evidence that they were going to like renew their permit.

What we tried to do in the 2014 analysis was use the best available knowledge we had about which – which tape off (inaudible) to include. So we did get some additional information from the state about which ones were not operational and which ones may have had permits but had zero animals housed there. So we did make some adjustment in this first paper to try to anticipate what would be included under the general permits.

But in terms of the methodology the analysis and the tables provided are the same. We changed the figures a little bit to try to make them look nicer and we also – there were 20 western counties excluded and that was using the same criteria as we did before. But there was just one additional county that met these criteria.

Mary O'Loan: OK. Yes, OK. Well that was a good explanation. So can we now turn to the – we're going to work from the 2014 (inaudible) you know what we have in front of us. And maybe when you made the changes some of our questions will be answered.

But I just – I wanted to start on page 11 just with figure 1. And I have no questions about that. Now I'm moving on to figure 2.

Mariane Engelman Lado: OK.

Mary O'Loan: OK. It says the percent of population living within three miles of an IHO in relation to the percent of people of color. Is that the percent of the population in the green study area or the –

Mariane Engelman Lado: Yes, so all of the data and all the table and figures provided here are from the study area. So figure 3. So in the complaint figure 3 is described on page 35 in paragraph 133. I should (inaudible).

And I guess the – what were asking you Dr. Johnston is well I guess do you agree that this statements states what your study shows and what that figure shows I guess?

(Jill Johnston): Can you read the statement please?

Mariane Engelman Lado: You don't have it? I'm sorry. It says as shown in the following figure which depicts the relationship of industrial swine facilities to the racial and ethnic composition of North Carolina swine facilities are clustered in communities of color.

(Jill Johnston): Yes, I would agree with that statement.

Mary O'Loan: OK – flipping.

(Jill Johnston): And now just to note this becomes figure 2 actually in the updated report. And here we kind of just have three categories of people of color. Anyway it's displayed more closely than how we conduct the analysis in the updated report.

Mary O'Loan: What do you mean? I'm not sure I understand what you mean.

(Jill Johnston): (inaudible) – so we actually had like six – six categories that we assign census blocks into six racial category. And on this map but as original figure in order to simplify it we just show three categories under 20 percent, 20 to 40 percent and then above 40 percent.

Mary O'Loan: We – that was actually a little hard to hear. Can you say that again?

(Jill Johnston): I'm sorry. So on this figure the figure 3 we show – we just showed three categories just that we simplify for purposes of displaying the information which was less than 20 percent, 20 to 40 percent and greater than 40 percent whereas in the updated figure we show all six categories that we use for our analysis. So it's just a minor and it doesn't impact my interpretation of it.

Mary O'Loan: OK.

(Jill Johnston): But just to note if were discussing these changes between the two versions. That was one. We just changed how we displayed the information.

Mary O'Loan: OK. in the updated version it's figure 2 on page 11.

(Jill Johnston): Yes.

Mary O'Loan: OK. So now were moving on to table 2. So table 2 is – table 2 is discussed in a handful of paragraphs in the complaint. So I guess I will just read them to you one at a time.

So this is paragraph 132 on page – I don't know what – wait. 13, so it's 13. No. It's not. What am I talking about? 35, paragraph 132 on page 35 of the complaint. And we are talking about table 2 on page 13 of the study.

Paragraph 132 says analysis of the populations statewide yields consistent result. The proportionate of African Americans, Latino's and Native Americans statewide living within three miles of an industrial swine facility are 1.4, 1.26 and 2.3 times higher than the percentage of non Hispanic White respectively which (inaudible) is varied are also statistically significant. Is that right?

Mariane Engelman Lado: Yes, table 2.

Mary O'Loan: I would note that refers to both page 6 and table 2 of the report. The (inaudible) 32, 132.

Mariane Engelman Lado: OK.

Mary O'Loan: That is basically your sort of quoting page 6. Is that what you're saying?

Mariane Engelman Lado: I believe so.

(Jill Johnston): So that statement I think maybe actually doesn't draw on table 2 that we have shown here which is just for the study area. I think – I believe those numbers that you've read are for the whole state for a statewide analysis where we don't exclude any areas.

Mary O'Loan: OK. So which table should this or this about? Where are those results displayed? Here. It's the first paragraph on page 6, OK.

(Jill Johnston): I am not sure of all the tables from our statewide analysis were included in the documents sent to you.

Mary O'Loan: You mean – OK. So the document dated August 29th, 2014, Industrial Hog Operations in North Carolina. What you're saying is there's results discussed in the text that aren't displayed in the table or figure.

(Jill Johnston): Yes, so all the tables and the figures provided in this document are just for the analysis where we restructured to the study area as (inaudible) –

Mary O'Loan: OK.

(Jill Johnston): But there was a parallel analysis that didn't restrict that like included all (inaudible) in the State of North Carolina as of these results included in the text on page 6 (inaudible) analysis that uses the entire population.

Mary O'Loan: OK. OK. Just to draw your attention to paragraphs 131 and 132 of the complaint. 131 says analysis based on the study area that excludes the state

five major cities in western county. And then goes on to give the numbers. And then paragraph 132 by contrast says analysis of the population statewide yields consistent result.

So paragraph131 is about the data in the study area and paragraph 132 says it's consistent but here are the numbers for the state – for a statewide run. Is that correct (Jill)?

(Jill Johnston): Yes.

Jeryl Covington: So 131 again is just for the state –

(Jill Johnston): OK.

Jeryl Covington: Or Statewide?

Mary O'Loan: Paragraph 131 says analysis on a study area so it's for the state but only the study area within the state. And that's what the tables reflect. Paragraph 132, the very first sentence says analysis of the population statewide yields consistent results.

So that's – those numbers 1.4, 1.26 and 2.39 which are the same numbers that appear at the top of the report on page 6 first paragraph is the statewide numbers not just the study area.

Mariane Engelman Lado: So the reference table is not because those numbers come from table 2. But because table 2 – wait. What is it? It's not about – the reference to table 2 should probably be like C also. It's – you know I think table, I'm sorry.

Page 6 is the actual support where table as – as Dr. Johnston said seems to be only the study area. Is it all state in the original?

Jeryl Covington: Well it's racial and ethnic composition of (inaudible) is blocked within three miles of an (inaudible) IHO and more than three miles. So it's the study area excluding the western county.

Mary O'Loan: (inaudible) the study.

Jeryl Covington: Let me (inaudible) –

Mary O'Loan: OK, so I'm sorry. So this paragraph is basically saying that the statewide results are consistent with table – the proportions are consistent with table 2 which is about the study area?

Mariane Engelman Lado: Right.

Mary O'Loan: Dr. Johnston is that right?

(Jill Johnston): Yes, yes, so yes, I open up the – I found the document. So yes, so 131 is the proportion matches within table 2 and then 132 is referring to the state wide analysis with no exclusion areas in which that we did not show the table in this report.

Mary O'Loan: OK, great. We're going to go to – I think so paragraph 140 in the complaint I think it's sort of repeat of that. The statewide proportion of African Americans living within three miles of an industrial line facility – statewide is 1.4 times higher than the proportion of non Hispanic white in that site, table 2 and in page – table 2 and page 6.

(Jill Johnston): Yes, I believe that's the – as the same (inaudible) one about matches that the table. In this report that is the study area and then 140 versus the statewide analysis.

Mary O'Loan: OK, 142. OK, so the next paragraph then is 142. Are we having the same issue here – the same thing going on. African Americans make up a larger portion – proportion of the population living in (inaudible) industrial

(inaudible) and the proportion of the population living within three miles away from any facility with disparity.

(Jill Johnston): I believe that (inaudible) right that the 20 percent of African American compared to 13 percent of non Hispanic white that live within three miles of a (inaudible).

Mary O'Loan: I'm sorry were you quoting again from paragraph 132?

Mariane Engelman Lado: What are you talking about 142?

Mary O'Loan: 142, OK, thank you.

Mariane Engelman Lado: (inaudible). And it doesn't provide the numbers. But I believe the reference seems appropriate.

Mary O'Loan: OK. And the statement is accurate? 142, OK. Now were moving to 148.

Mariane Engelman Lado: Yes, that's the same. That's in reference to the statewide analysis.

Mary O'Loan: OK and that's accurate?

Mariane Engelman Lado: Yes.

Mary O'Loan: And 150. That's 0.2. This is a – Yes, I believe that is correct.

Mariane Engelman Lado: OK. So I'm just trying to reach back and – and Dr. (Johnson) you may remember as well these reference to table 2 there are different ways of looking at them. And one maybe that we met kind of the report six provides the information. It's more like a see also table 2 with consistent results. But – but the other way of thinking and I remember that there were lots of charts and tables with the numbers.

And I think and again Dr. (Johnson) you may remember better than I. We may have taken some charts and tables out simply to make it all more

presentable because it was kind of too long and too much. And if we did could this table 2 could have referred to statewide analysis.

I just don't remember if there was an earlier job with more tables but I seem to have some vague recollection and if so that it may just be kind of type o. But again it's also perfectly consistent, you know, that we may have just thought it also supported by table 2.

(Jill Johnston): You're are correct that some variation of all these tables included everything from the study area analysis and then a repeat, you know, maybe like, you know, 2A and 2B or something. I don't know exactly how we weighted it out but sometimes the study area to the whole state analysis. So it could have drawn on that.

And maybe the different iterations change. We try to not have quite as many table.

Mary O'Loan: Well I'm – this is Mary. I'm beginning to think maybe it would be a good idea to send all the tables in because I know that, you know, there were some questions here about numbers and stuff. So we could certainly look for any tables that we had that included the statewide analysis which is the piece here and because, you know, if we have something.

Also, you know, as these tables were being developed Dr. (Ling) and Dr. (Johnson) may have gone back to the data and tweaked, you know, and found that there was a mistake that we included (inaudible) or we included something else that had to be cleaned. So I don't want to send over stuff that isn't correct, isn't final, right? But because – because they worked on this and I said before there was a lot of work going into refining the data and then refining the methodology.

So but what we can look to see if there were – I do have a recollection that we may have had some near final tables that might have included the statewide data. And we just thought it was too much. So if we have that we can

certainly send that over and we'll look for that. I'll put a star next to that as a to do.

Mariane Engelman Lado: All right, thanks and when – just asking. So the tables don't have headers on them. they're descriptive like the ones that are here. So table 1 is –

Mary O'Loan: I'm not sure were looking for a totally free standing table or is Dr. (Johnson) said it may have been this table was an additional column. And we just thought it was too confusing to have all that information in one column. It's that kind of thing.

So – so it would have a header, you know, if it were a near final version. But I just don't – it's a couple of years ago. And by the time the revisions came long it was more like using this 2014 version as a base so some of these questions weren't revisited again

So its two years ago and I'd have to look back and confer with Dr. (Johnson). But I think there maybe something that we can send over to you with statewide data.

Female: Yes, we may have to format I'm not sure all the information ended up in this final format but the version of the data available.

Mary O'Loan: OK, all right. So turning back –

Female: Just to be clear as I read this and Mary you can correct if you're looking for something that I'm not thinking or Dr. (Johnson) correct me if I'm wrong about this. But the data is actually in on page 6. It's just that it's not presented in, you know, in table 2 and the references from table 2 and that's a little confusing. So if we can find that so it I'm happy to do that. But it doesn't -- Dr. (Johnson) does it change any of your conclusions or is there anything different or new about that data?

(Jill Johnston): No, I think it's consistent with what we – with the table that we show. And that, you know, the number and the text and what seems to be in this complaint form are correct.

Mariane Engelman Lado: OK. So, you know, we wanted to – I'm looking at the clock it's five after four. But we wanted to, you know, March through sort of these paragraphs to have you, you know, do what you've been doing so far which is that it's saying yes, that's an accurate characterization of this – this table. And then, you know, after that we have a handful of other questions.

But I'm wondering if there's an easier way to do this than just doing it on the phone here so that we can move on to the other kinds of – the other questions that we have. Did you -- Dr. (Johnson), did you write these paragraphs that are in the complaint or did you – and or did you – did you write them? That's the first question.

(Jill Johnston): No, I did not write them.

Mariane Engelman Lado: OK. Did you review them all before they, you know, came to EPA?

(Jill Johnston): I reviewed a version of them. I can't say whether it was the final version or not.

Mariane Engelman Lado: Yes, here's what I'm trying to do. Mary and I think you probably see what I'm trying to do here. I just want to make sure that – that Dr. (Johnson) because she didn't write it. But she does agree with what it says.

And that's all I'm trying to do to make sure that now when we use it, you know, when we – if we were going to, you know, use the languages in here that it's – that we can adopt it just trying to (inaudible) here. Let me propose this since Dr. (Johnson) – we didn't know that this was what you're going to do and Dr. (Wing) also reviewed these paragraphs.

And well, you know, we may have six type o's after he reviewed it. He definitely reviewed the final version. I – but perhaps since we didn't expect this line of questioning and Dr. (Johnson) has a copy of the complaint after the phone call either if you can identify which paragraphs you want her to review –

Female: Sure.

Mariane Engelman Lado: And so you can look at them and we can follow up. And if there are any points of divergents of course Dr. (Johnson) should say so on those paragraphs. But (inaudible) have time to review them and she can get back to us.

Female: Yes, I think that's more efficient.

Mariane Engelman Lado: OK. OK, is that OK with you Dr. (Johnson)?

(Jill Johnston): Yes, I can do that.

Mariane Engelman Lado: OK. Which paragraphs is it or do you want to e-mail us?

Female: We're going to e-mail it. Yes. And we'll have to e-mail you the list.

Mariane Engelman Lado: OK, the next question is I think we're already gone. It's hasn't been – the study has – now we're moving off the, you know, this sticky thing and moving into more general questions. So the study hasn't been published. And you're checking Mary on whether it was provided to DEQ.

Mary O'Loan: Yes.

Mariane Engelman Lado: OK. And I don't think we need to answer the next two. Do you know has this been made public in other way?

(Jill Johnston): I believe that on Earth Justice Website.

Mariane Engelman Lado: On the Earth Justice Website?

Female: Is that correct?

Mariane Engelman Lado: OK, then maybe I will after next question. Are you aware of any of response or criticisms or critiques of the study, you know, that are out there?

Female: I am not and Dr. (Ling) hasn't shared any with me if he has received something.

Mary O'Loan: Mariane have – have you?

Mariane Engelman Lado: I'm thinking. To be – to be as – as complete as I can but I'm racking my brain and I – I don't think I have received any critique or response for the disproportionality analysis.

Mary O'Loan: OK, all right. Well, you know, if you do come across anything, let us know. OK, now – now I just wanted to talk about the 2000 study. And mainly it's the differences between the 2000 study and the 2014 study. And, you know, sort of why those changes occurred if you know the answer.

So, one of the changes was –

Mariane Engelman Lado: I'm sorry before you go in to that, I like you to just hold up the –

Mary O'Loan: Yes.

Mariane Engelman Lado: -- our Website and it's look the disproportionality analysis is available through our Website.

Female: Not on the Website?

Mariane Engelman Lado: Not on our Website? Where?

Female: North Carolina Policy Watch.

Mariane Engelman Lado: North Carolina Policy Watch.

Mary O'Loan: OK. Complaint or the study?

Mariane Engelman Lado: The study.

Mary O'Loan: OK, good, OK.

Mariane Engelman Lado: But – OK, then if you heard that the 2014 analysis seems to be available on North Carolina Policy Watch. We – just also so, you know, this is a little bit of an (inaudible) from this interview but we have not generally made available the declarations to the press or to other people. We – we in general when we've got an inquiries we will call the declarant that might have information responsive to an inquiry.

And ask whether it's OK if we share their declaration even for people who did not ask to have their information anonymous. I mean it's anonymously and – and as, you know, there was – that – that there was that category as well. But we are, you know, -- we are respectful of people's courage and concerns about retaliation and so we've been very careful not to just throw everything up on the Website.

And it doesn't run to the disparities analysis but we haven't just put all the exhibits up on our Website or in any other place. So, that's – that's part of the backdrop as to why I'm not clear to where we sent what.

Mary O'Loan: OK. Did North Carolina Policy Watch just picked this up off of your Website? So, I'm wondering, so you said you haven't received any critiques. I guess I'm wondering or criticisms or, you know, any – anything not off the wall. Could it have gone in to –

Mariane Engelman Lado: North Carolina –

Mary O'Loan: North Carolina Policy Watch.

Elizabeth Haddix: It's a – this is Elizabeth.

Mary O'Loan: Yes.

Elizabeth Haddix: North Carolina Policy watch picked up the complaint from the centers Website and I'm not recalling any discussion that I had with them. But it would not surprise me at all because they're – they are investigative journalist that they would dig in to studies referenced in the complaint and share this with the public. So, in that – since the 2014 study, I mean it was not confidential, it's not surprising that they posted it on their Website.

Mary O'Loan: And Dr. (Ling) may have been talking to members of the public and providing copies since it wasn't confidential.

Mary O'Loan: OK.

Elizabeth Haddix: I'm pretty sure that they had also posted the 2000 report a long time – years ago.

Mary O'Loan: Right.

Elizabeth Haddix: So, it – it could be also that they've just been practicing Dr. (Wing's) work so.

Mary O'Loan: Do you have a relationship with them or they just pick your stuff up and – and they put it up there. Because what I'm wondering is whether they were on the receiving end of anything legitimate as far as the critiques.

Elizabeth Haddix: I do – we do have a relationship with them (inaudible) relationship with them so

Mary O'Loan: Yes, we, you know, we're interest – we are interested in it. I mean we're going to look to but we don't know what, you know, if they curate their site or

what happened. So, we would be interested if – if they happened to have anything.

Elizabeth Haddix: I'll find out.

Mary O'Loan: OK, sure, great. Thank you. OK so – so circling back Dr. (Johnson) to the – to the 2000 study and some of the changes in the methodology from that study to the 2014 study. One of the things that was discussed in the 2000 study had to do with well water. And looking at those that were – you know, somehow including those and now I can't remember because I'm – I'm looking for it now.

But that was taken in to account but that wasn't discussed in the 2014 study.

Female: So, my understanding in that report they looked at sort of three different vulnerable populations. One being racial and ethnic minorities, one, do you know looking at people living poverty. And a third looking at people who are relied on well water, but so – the – they all of three variables we're not included in one model because they were sort of three parallel analysis that looked at the correlation between those different categories stick to the population and proximity put to (inaudible).

Mary O'Loan: OK. And the well water components wasn't done in 2014, do you know – is there a lead in –

Female: Yes, I mean so specifically we kind of prioritize looking at racial and ethnic disparities in that analysis. And just – just a limited focused specifically on that issue. But also – so the 1990 census included information about people's drinking water resources. But the best of my knowledge that is the last census that included that data so if we wanted to look at data in, you know, in the 2020 start (inaudible) the 2010 census.

They did not include questions asking about drinking water.

Mary O'Loan: All right, great, thank you.

Mariane Engelman Lado: It's like this is Mariane if I could just interject, so because this is – this was not a general study for the general public but a study to test whether there was a racial disparity related to the general permit. The – the request was to examine that question whether there are disparities on the (inaudible) and ethnicity. So, you know, there's a difference between doing a study, you know, for the general inquiry of, you know, of vulnerable populations and – and their relationship to (inaudible) and looking in to the relationship on the basis of race and ethnicity and whether the civil rights law is violated.

So, it was really a question as to whether or not there was a disparity that cognizable under the civil rights law that, you know, that Dr. (Ling) and – and Dr. (Johnson) generously took up. So, that you know, -- that's a big part of it here.

Mary O'Loan: OK. Yes, I – I understand what you're saying Mariane. OK, the – so the next question it has to do with the distance and we talked about a little bit earlier. And I think that 2000 study did one and two mile buffers and now this one goes to three so can you – can you – and the next one has to do – the next question I have has to do with the measurement. The idea of moving off the buffer zones around the – since the black group area to using the center.

So, I mean maybe it's all related but if you could explain that.

Female: Yes, yes so a major difference between the – for the special approach that we took in these two different reports is in the 2000 reports they relied on black groups.

And so here there was a little over 4,000 black groups included I believe in the study area. And so, with our report we have over 200,000 blocks in our study area. So, the size of the blacks and the size of the black groups are very different especially in rural areas because they sort of and acrid to have, you know, similar types of populations in terms of counts in the – in these different census like geographic areas. And so rural areas the black groups tend to be very big and so – so they were looking at the – the principal

analysis in this 2000 report wanted to see if there was any (inaudible) in the black groups.

And that as sort of a sensitivity approach because, you know, you can have (inaudible) right in the corner of a black group and so that could impact it's neighboring black groups as well or a proportion of that population. So, as a sensitivity approach they also look at, sort of one mile around the black group and then two miles around the black group and included, you know, the category of whether or not it was near a (inaudible) or it's adjusted based on those parameters.

So, in contrast when you look at blocks, I don't remember the exact number but, you know, there's a little over 2,000 (inaudible) in the state so if we were just to assign exposure based on whether or not there was a (inaudible) in the block, you know, that went down to like fewer than a thousand blocks because they're just much smaller. And so for – for this analysis it – when – when you're using blocks as your unit of analysis then – then you need to consider I mean we believe it's important to consider a buffer zone around it because we know how chemicals can travel off site.

And so, you know, using evidence a lot of papers that have been published since 2000 we sort of relied on a – a three miles buffer for the 2014 report. But that is – I mean the – the special scale of the few are just – it was very different and so that's part of these and issue their difference in what kind of buffers, what considers.

(Jill Johnston): Let – let me ask what – and this is (Jill) so I'm – I'm understanding that you all looked the blocked group and you still considering I guess the travel, the air emissions of H2S, you all didn't overlay on this one as well to come up with that distance.

Female: On the 2000 report?

(Jill Johnston): Yes.

Female3: So, the choice of the one and two mile buffers I can now specifically speak to.

(Jill Johnston): OK.

Female: As our part – I believe the data presented here in the table don't specifically include the buffer zone but that was used as a sensitivity analysis. So, if we included these buffers or change their definition of exposure with the patterns that we changed and – and from my understanding of this report, you know, the patterns were – were consistent but I believe the tables show rely on the definition of that blocked group is exposed if there's a capo in that blocked group.

(Jill Johnston): I'm going to repeat that. So, you're saying the block group is exposed if there is a capo in that blocked group?

Female: Yes, that was the primary definition of the analysis from – from my understanding in this 2000 report.

Mary O'Loan: And the one and two mile buffer around the block group was not that populations were measured one and two miles outside of that blocked group? For some other reason.

Female: Yes, so it would take – so perhaps there would be no capo in a block group.

Mary O'Loan: OK.

Female: But if you do a one mile buffer around it there would be a capo. So, under that condition you would include that block group as this population is exposed to a capo. And – it doesn't specify I assume because it's block group that's using like around the – one mile around the buffer rather one mile from the centroid.

Mary O'Loan: Yes.

Female: Because – you know, because block groups are so much bigger so – so you wouldn't get much outside the boarders with that definition.

Mary O'Loan: Dr. Johnston –

Female: Yes.

Mary O'Loan: And so just to – just to make sure I have it and it's clear when you say you would include that (inaudible) that's in the buffer off to two miles away in exposure that would be in the sensitivity analysis but not in – I don't know what you call it but the core analysis.

Female: Yes, that's how, you know, I don't want to say 100 percent because I do not make these tables. But as I read this paper and how I understand the data presented is they're not using the – the buffered definition. They're – they're just using the category of whether or there's an (inaudible) inside the block group.

Mary O'Loan: OK, OK, anybody else? All right so the next question and Mariane, I think this probably goes back to what you've already said but. Why was poverty omitted this time?

Female: Yes, I think it goes back to the same point is that we were, you know, looking at – at criteria that were considered under the – the civil rights act.

Mary O'Loan: OK.

Female: And – and so, you know, poverty not being one of those classes considered we didn't included it in the analysis.

Mary O'Loan: OK. Are there any other differences that you by chance know about between 2000 and the 2014?

Female: I mean, you know, the – how we assigned which people were exposed. We're different also this analysis includes all commercial (inaudible) in the state of

North Carolina whereas the 2014 we restricted to those (inaudible) that are covered under the general permit. So, it does not include ones under the individual permits or under (inaudible).

Mary O'Loan: OK. Didn't you Dr. Johnston, explain what you mean by how the – how people are assigned. Are you referring to the use if quintiles and can you explain what the significance of that is.

(Jill Johnston): Yes, so actually now as (inaudible), you know, it was – you're considered to be exposed to a (inaudible) if you live in a block group with the (inaudible). You know, whereas in our – in our 2014 report, you're considered to be exposed to a (inaudible) if you're – the centroid of your block is within three miles of (inaudible).

Mary O'Loan: Right.

(Jill Johnston): But, yes, here also the – we – we take a similar approach to using your (inaudible) variables to account for non-linearity in the relationship between, you know, racial composition and proximity or exposure to (inaudible). But in this 2000 analysis they divide the group so that in each of the prior groups there's an equal number of block groups in it. So, that's how they defined their power point. So, for example like the – what was quintile is (inaudible) at 2.3 percent, the highest quintile more than 44 percent people of color.

Whereas in the updated (inaudible) we used partly just – because we thought it was a little bit more intuitive and easier to understand. We categorized the percent people of color in to equal – like equal percentages.

So, our reference group was the (inaudible) percent people of color because that was a high percentage of population where they live in blocks with no people of color and then divided it from, you know, more than (inaudible) with the 20 – 20 to 40 in this group of 20 percent. Because it's – it's a low risk I think easier to communicate rather than having to talk about, you know, that quintile versus that quintile and also because then we're able to look at, you know, these census blocks that are majority people of color.

Mary O'Loan: So, Dr. Johnston so that the – just a follow up on that. So, that if you used quintile it would have – would you – it would have been difficult to say anything meaningful about the effect of living in a – over 60 percent versus over 80 percent people of color community but using your methodology you could get more granular on that basis? Is that – is that right? I didn't hear the answer.

(Jill Johnston): I'm sorry. Yes, that is correct.

Mary O'Loan: OK. OK. Anybody else have any other questions, comments? OK. So, the 2000 study and – and, you know, maybe you – you may not be able to answer this but are you aware of any criticisms of that study. So, I think that – wasn't that submitted in one of the general permit processes? So, I'm wondering if they got more play in the outside world then if, you know, what reaction there may have been to that that you're aware of or critiques?

(Jill Johnston): I mean it was polished and as I know how pushed back is with this, you know, I had quality journal and environmental house codes went to the pair of new process. But I can't speak to any of critiques of it.

Mary O'Loan: OK. All right, where are we now? I think we're close to wrapping up here. we have a general – one – one last – one question here is the – is the generic one that's – that's all experts get asked and you probably seen it on TV which is the – you know, were you compensated for doing the study.

(Jill Johnston): No. No, I was not.

Mary O'Loan: OK. And the other question I have – I heard somebody laughing we're wondering if – if you had worked with Dr. (Ling) on any other studies related to swine and – and swine farms of North Carolina.

(Jill Johnston): Yes, I worked with him and also Dr. (Getri) around that analysis of hydrogen sulfide concentration near middle schools in Eastern North Carolina which was recently published.

Mary O'Loan: OK, that was – I think that is in your CV or was referenced on your CV, is that right?

(Jill Johnston): Yes, yes.

Mary O'Loan: And – and I was just going to interject here that that work and – and (Dr. Johnson's) experience working on studies generally community based participations studies and other work in the community on which she might base opinions about the adverse impact of – of swine (inaudible) could be subject to another interview as we kind of went back and forth on – that wasn't the premise of this interview but –

(Jill Johnston): Right.

Mariane Engelman Lado: But she's generously said that, you know, if – if she knows in advance that she'd be more than happy to talk to you about that body of work in the research associated with it.

Mary O'Loan: OK, that would be great. Did – did the hydrogen sulfide study get submitted with the materials you sent in April Mariane?

Mariane Engelman Lado: Yes, it is the study that is – it was confidential at the time but it is since been published. So, it – it's – it exhibit but it also says it's confidential.

Mary O'Loan: OK, so –

Mariane Engelman Lado: It was pre-publication at that point.

Mary O'Loan: We have a – the – I'm trying to find – do we can – can send up the publication copy just to make it easy?

Mariane Engelman Lado: Yes.

Mary O'Loan: For us the – the published version, that would be great. You have any other questions right now, do you have another one?

Female: I don't think so.

Mary O'Loan: Is there – is there anything else that – that you wanted to add Dr. Johnston?

(Jill Johnston): You don't – no, I don't believe so, I think if you have a chance to review or update the report then I'm happy to answer any questions or if there are any clarifications related to that but if – if I was a pretty parallel structure that you have we just refined the which (inaudible) we're in included in the analysis.

Mary O'Loan: OK , and so, yes, and I'm kind of thinking Mariane since I haven't had a chance to look at it that, you know, how we were going to send you the paragraph that we wanted to do. I have a feeling we're going to – we have to fix because we have to switch it now to the – to the newer study. So, there's a newer study – what you submitted Mariane, is it going to include – is it's just a new study or do you have a cover letter that it's like the complaint that goes through and, you know, here's the – here's the layman, you know, description of what is in – the support.

Mariane Engelman Lado: So, it's a little bit of a hybrid in the sense that we have the complaint and we're – we're filing additional submission in support of the allegations in the complaint. We don't amend the complaint and say this goes to paragraph 132, we rather are just submitting additional documentation in support of those allegations. So, there is a – a short cover letter but it's not – it's not lengthy and, you know, doesn't go in to which paragraph that it's supports.

Mary O'Loan: OK.

Mariane Engelman Lado: OK, the other thing I was thinking might be useful since we're ending up a little bit early which is good is just to say a little bit more about Dr. Johnston experienced, you know, and background and expertise on methodological issues and, you know, -- and of course it's (Todd) or -- or

research done or either you have her CV and I think Jeryl Covington asked some questions earlier on but if you have any questions out that are – or I would just open up to Dr. Johnston to say a few more words about whether you have taken any courses or have any special training or expertise on methodology in epidemiology and public health.

(Jill Johnston): Sure. I mean because the starting point is, you know, that's – that was not submitted to the (inaudible) process but there's a recent publication that – that are authored in the American Journal of Public health. That – so the uses are very similar approach to a racial disparities analysis. It's around a different topic looking at waste water disposal wells in – in South Texas so not related to industrial animal operations. But, you know, when did the peer review process used (inaudible) data and – and a very similar approach to that.

So, there is, you know, some of – some of that sort of expertise and – and credentials in the peer reviewed literature that – that is similar methods to what we're doing here in this paper. You know, but also, yes I mean I do have fairly expensive course work and the – these different types of – of progression modeling epidemiological study designed and also just quantitative data analysis process like both in, you know, in biostatistics and epidemiology and then also in the (inaudible) metrics.

And – and then, you know, I had a two year post doctoral fellowship and environmental epidemiology and – and co-taught class with Dr. (Ling) specifically on community based epidemiological methods and environmental justice.

Mariane Engelman Lado: OK, well thank you actually that was helpful particularly to the reference to the West Texas or the – the –

(Jill Johnston): Yes, so (inaudible) I mean I can send it to you but it's also included in my CV and, yes maybe helpful I – I think it's from critiques on – on the – from the oil industry but nothing that – that was really methodological driven but – but yes that can – it's – it's a reference in the peer review literature that's – that takes a

very similar approach to – to had it analyze data in a racial disparities analysis as (inaudible).

Mary O'Loan: OK, is it – is it easy for you to send us that report that because that – that –

(Jill Johnston): Yes.

Mary O'Loan: -- I think that would be helpful and then –

(Jill Johnston): Then maybe I could send it to Mariane and then – and in her package she can share with you.

Mariane Engelman Lado: Yes.

Mary O'Loan: Great. And the – the oil and gas industry comments or response or whatever you want to call it. How – like what form did that take?

(Jill Johnston): It came out to a reporter that shared it to me – with me.

Mary O'Loan: Can – would you be willing to share that as well?

(Jill Johnston): Yes, let me – let me review it but probably –

Mary O'Loan: OK. OK, did anybody else have any questions at this point? OK. So, we – we have some follow up, we have some things to give you, we'll wait for your list of paragraphs as well and exchange information and then it's sounds like on – on the – the follow up report that was submitted this year as well as the more recent study as well as other studies and work on the adverse impacts we should schedule another interview time.

And we can try to do that relatively quickly I think if – if you like so let's try to get that all under way.

Mariane Engelman Lado: Yes, I think we'll have to – to get back to you on that.

Brent Ducharme: Yes, yes Mariane what I – what I have identified so far is that you will be sending after you review the background, the statewide study so that we can correlate the tables and the statewide data that you have in the – in the report. We will follow up on whether that questions for the paragraphs are relevant. We need to review the data that you just sent to us on April 12, 2016 to see if those questions have been answered. So, we'll have to review that e-mail and I did receive those e-mail submission.

So, let us look at that and then we'll probably coordinate amongst ourselves on the follow up interview with Dr. Johnston and yourself.

Mariane Engelman Lado: Sure (inaudible) if you could send me some dates. I – I think what we said on the statewide data is if there are final charts again, I think it's just a reference problem and the complaint to this table to –

Brent Ducharme: Yes.

Mariane Engelman Lado: If there was another table too with the state wide data or another table with the state wide data or another column in an earlier draft that, you know, sufficiently well along, we'd be happy to send it to you.

Brent Ducharme: OK.

Mariane Engelman Lado: But we will – we'll look for that and get back to you on that.

Brent Ducharme: OK. And the – the follow up we did receive in the April 12 submission the (inaudible) report that is marked confidential and I think you're going to submit that after publication without the confidential reference to it.

Mariane Engelman Lado: Correct.

Brent Ducharme: And Dr. Johnston is going to do the supplementary information on the oil and gas disparity analysis literature to you and then you'll subsequently submit that to us.

Mary O'Loan: So, I think it would be the publication as well as she's going to review the feedback she got to see if it's appropriate to forward.

Mariane Engelman Lado: Right.

Brent Ducharme: Right. OK.

Mariane Engelman Lado: Terrific. OK, OK. Thank you.

Mary O'Loan: Yes, I think that's it for now.

(Jill Johnston): OK.

Mariane Engelman Lado: OK.

Mary O'Loan: All right thank you very much and thank you Dr. Johnston.

(Jill Johnston): All right thank you.

Mary O'Loan: OK, bye-bye.

Operator: The leader has disconnected, the conference will now end.

**END**

END

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## SUMMARY OF DECLARATION REACH TITLE VI COMPLAINT

### Sorted for On-site

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| 1 | 8 ***4/12*** | 1 | Personal Privacy / Ex. 6 | AA | Warsaw Duplin | | 5/1 mile 30/3 miles | Waste gets on her car, lawn and home.<br>1 mile is 25,000 hogs & 8 lagoons.<br>2 miles is 80,000 hogs<br>Spray in morning & at night.<br>Dead box ½ mile down road near cemetery. Dead boxes smell worse than spraying or confinement houses.<br>50 feet from spray fields including one across the street. (submitted CD with spraying – I do not have a copy & have not seen this CD). So many spray fields on this road that I smell the hog waste all the way to Warsaw.<br>Medical conditions came after & believes are caused by hog farms: Heart problems, sinus & breathing issues, Sarcoidosis (bacteria in lungs) & eye bacteria.<br>Loss of use & enjoyment (e.g., can't have cookouts, open windows, take walks or garden, hang-dry clothing}<br>Buzzards<br>Increased expenses: laundromat dryer. |
| 2 | 9 ***4/12*** | 2 | | AA | Kenansville Duplin | P | 24/3 miles | See hog trucks every day. Guts & liquid on the road. Used to have job emptying dead boxes. Dump them in open air hole in Rose Hill.<br>Brown fog when spraying. No warning of spraying.<br>Loss of use & enjoyment: can't go outside, hang-dry clothing, can't open windows, daughter can't play outside. Flies and other bugs constantly around.<br>Increased costs: A/C. Pays $23-$33/monthly |

[1] Race or National Origin. AA = African American. W= white. H = Hispanic. NT = Native American.
[2] Source of drinking water. W=well, P=public system.

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | County made him switch to county water but doesn't know why – maybe contamination from hog waste.<br>Daughter can't go outside due to asthma being triggered by spraying.<br>Eye/nasal allergies have worsened due to spraying.<br>Still has to boil county water because it doesn't look or taste right. Can't afford a water cleaner and is upset that he has to pay for county water that still isn't clean enough.<br>Poultry |
| 3 | 10<br>***4/12*** | 3 | Personal Privacy / Ex. 6 | AA | Roseboro<br>Sampson | W | 2/ 0.5 miles | Spray field couple hundred yards from house. 3 days a week smell powerful (summer)<br>Dead box 2 miles from house 50 ft from road. Buzzards & sight ghastly.<br>Loss of use & enjoyment (e.g., Grandchildren won't visit, can't sit outside, visitors ask to stay inside or leave, can't host or grill outside, avoids going home, wears mask to mow lawn).<br>Sinus problems & allergies year round. Believes cancer/sinus infections among local African Americans is unusually high due to spraying. Gag & vomit if don't have mask.<br>Increased costs: A/C running constantly, on bottled water about $18/week or $900/year, buying fish.<br>Can't sell home due to smell.<br>Young people leaving. Don't see people doing outside activities – washing car, basketball, sitting on porches<br>Can't fish due to contamination & has to buy fish from grocery store. |
| 4 | 5<br>***4/12*** | 4 | | AA | Warsaw<br>Duplin | W | 10/3 miles | 2 hogs farms within ½ mile. Sees spraying.<br>Can see dead boxes from his house. Seeing dead hogs & them being hauled away is disturbing & disgusting.<br>Loss of use & enjoyment: Can't go outside, walk, gardening, can't breathe due to smell, can't breathe or open doors/windows.<br>Trucks with dead hogs & live hogs driving by have horrible smell. Sound of squealing hogs horrible interrupts sleep. Trucks go by once a day. More when moving hogs in & out about every 3 or 4 months. |

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Worries about well water contamination, but county refuses to hook his house up.<br>Worries that the air from hog facilities is effecting his health (*e.g.*, sneezing). |
| 5 | 8 | 5 | Personal Privacy / Ex. 6 | AA | Wallace Duplin | P | 8/1.5 miles | Loss of use & enjoyment, no cookouts, can't sit on our porch & visit with neighbors, limits 4 wheeling, windows closed.<br>Burn eyes & nose. Sinus infections & nasal problems.<br>Well contaminated, now has town water. Cost for water.<br>Used to fish & hunt for food. No longer fish in or hunt.<br>Hog farm next to Charity Middle School & to Peter's Tabernacle Personal Privacy / Ex. 6 Personal Privacy / Ex. 6 Flies. |
| 6 | 9 | 6 | | AA | Warsaw Duplin | P | 11/2 miles | Loss of use & enjoyment, no cookouts, can't sit on our porch. No clothes outside–extra washing if do. Flies.<br>Nausea, vomiting, runny nose, lung issues,<br>Well water tested by state DWR in Wilmington, told can't drink or cook with it.<br>Increased costs: Had to buy water until hooked up to county water. Had to pay for hook up.<br>Afraid of county water in case there are breaks in the line where hog waste seeps in.<br>Farmer tried to intimidate when found out about well test results. Said her 2 puppies were the cause of contamination.<br>**Personal Privacy / Ex. 6** & smell limits use & enjoyment there too. |
| 7 | 16 | 7 | | AA | Warsaw Duplin | P | 28/2 miles | **Personal Privacy / Ex. 6** 13 hogs farms in 2 mile radius of office & home. (Aerial photo shows 28 CAFOs in 2 mi. radius, likely poultry included). Has to eat food inside during REACH meetings because of the flies and bad smell.<br>Can't fish anymore because the fish are starting to have sores on them.<br>Increased costs: Believes the lagoons contaminate the well water and had to hook up to the county water system. |

[3] "My cousins live directly in front of a hog farm. They live closer to the hog facility than I do. When they spray the waste goes directly on them."

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Dead boxes - Overstuffed dead boxes attract birds.<br>Works for REACH. Knows about people who have living near industrial hog farmers and dealing with hog-related MRSA.<br>Has found that water bodies tested as having E.Coli, MRSA, and other harmful substances have not been added to the state's list of impaired water bodies. |
| 8 | 17 | 8 | Personal Privacy / Ex. 6 | AA | Wallace Duplin | | 5/? miles | In past, waste blew onto the house and into the storm door and windows. Trees were planted as buffer, but waste still comes through & trees are now dying. River Road is wet with waste from sprayer.<br>Received verbal/physical threats from farmers. "The county lawyer" wrote letter threatening her with jail time for complaining to DENR or would have to pay hog farmer damages.<br>People in the health field still continue to tell me to close windows when cooking.<br>Loss of use & enjoyment, wear a mask walking to car and can't freely exercise.<br>Headaches, trouble breathing, and depression from spraying.<br>Increased costs: Hooked up to county water & has to pay for it.<br>Can't hunt or fish. |
| 9 | 10 | 8 | | AA | Wallace Duplin | P | 5/1 mile | Can see waste on cars, windows, clothes, and house. Hits passing cars on highway. Flies.<br>Loss of use & enjoyment, no cookouts, can't sit on our porch. Relatives don't want to visit. Embarrassment.<br>Nausea. |
| 10 | 11 | 8 | | AA | Wallace Duplin | P | 5/1 mile | Spray fields no more than 200-300 yds from home. Spray residue. Dead boxes. Flies. Buzzards<br>Loss of use & enjoyment, no cookouts, can't sit on our porch.<br>Burn eyes and nose. |

[4] Personal Privacy / Ex. 6 lives across from the spray field on River Road & across from Personal Privacy / Ex. 6 lives nearby in trailer. Don't seem to have a declarations from them unless they are either of the anonymous declarations.

[5] The map attached to declaration seems to show some sort of housing project/development off Bowdens Road near th Personal Privacy / Ex. 6

[6] Personal Privacy / Ex. 6

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | Personal Privacy / Ex. 6 | | | | | Increased costs: Had to buy & use clothes dryer. Switched to town water immediately when offered. Cost for county water.<br>Believes will have difficulty selling property. Hogs all around Rainbow Baptist Church. Restaurants near hog farms smell. Clinton & Lundy's pork processing plant smells. |
| 11 | 12 | 8 | | AA | Wallace Duplin | P | 5/1 mile | Spray field next door. Feel mist. Odor really bad 2 or 3 days a week. Loss of use & enjoyment, no cookouts, can't sit on our porch, have to exercise inside keep windows closed. Wakes them up in the night.<br>Embarrassment. Burn eyes and nose.<br>Increased costs: AC cost. Cost of town water is discolored & has odor.<br>Personal Privacy / Ex. 6 – which has hog farm 10 min. away. |
| 12 | 13 | 8 | | AA | Wallace Duplin | P | 5/1 mile | Child (15, now 17). Odor comes 5-10x per month.<br>Loss of use & enjoyment, no cookouts, can't play outside. Closest park is too far to drive. Hog farms affect where she wants to live when grows up. Wallace-Rose Hill High School. |
| 13 | 29 | 8 | | AA | Wallace Duplin | | 5/? miles | Spray field next door & sprays year round.<br>Loss of use & enjoyment, no cookouts, hold breath b/c on crutches when getting mail, going to deep freezer, no clothes outside, keep windows closed.<br>Increased costs: AC cost. Bought dryer.<br>Health issues, sinuses, bronchitis, breathing, sore throat.<br>Major Murray Hog farm |
| 14 | 34 | 9 | | AA | Duplin | W | 5/1 mile | Nearest hog farm is ½ mile away. Smells closer to spray fields.<br>Hunting.<br>Well water smells like hog waste. Tested 2009 found not safe to drink.<br>Increased costs: Cost of bottled water.<br>Loss of use & enjoyment, rarely goes outside, close windows. |
| 15 | 7<br>***4/12*** | 9 | | AA | Kenansville Duplin | | 4/1 mile | 9 trucks a day go by house. Stench lingers. More trucks in morning & covers schoolchildren at bus stop. Liquid from trucks permeates the ground & smell comes back after rain. Noise.<br>Spraying near house. No warning. |

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Loss of use & enjoyment (e.g., can't open windows, visit parent's cemetery, hang clothes out, take walks outside). Sometimes has to re-wash clothes due to strong smell.<br>Breathing problems, asthma. Personal Privacy / Ex. 6. Thinks hospital visits due to respiratory flare-ups are due to hog-waste pollution. High blood pressure.<br>Daughters also had health problems including nose bleeds, sinus draining, anemia, etc. Missed work b/c of symptoms.<br>Can't fish due to dead/deformed fish in local waters – Northeast Cape Fear River. |
| 16 | 15 | 10 | Personal Privacy / Ex. 6 | AA | Pink Hill Duplin | P | 7/1 mile | Hog farm 1/2mile. Poultry facility nearby. Odor for 3 days and flies. Loss of use & enjoyment, closed windows, can't hang clothes, no activities outside.<br>On municipal water, but it is brown.<br>Sinus problems, ear problems, asthma problems.<br>Believes will have trouble selling property. |
| 17 | 33 | 11 | | ? | Kenansville Duplin | | 7/1 mile | Loss of use & enjoyment, close windows, no clothes outside, no cookouts, can't sit on our porch.<br>Increased costs: A/C, cost of drying clothes.<br>Nausea, sinuses, throat<br>Decreased property values. Loss of use & enjoyment, Bad flies for 3 days after spray. |
| 18 | 19 | 11 | | AA | Pink Hill Duplin | W | 7/1 mile | Closest hog farm less than ½ mile.<br>Loss of use & enjoyment. Can't hang-dry clothing, sit outside.<br>Believes emphysema and use of oxygen tank due to spraying. Can't breathe well.<br>Would like to switch to city water, but can't afford it.<br>Home value decreased.<br>Can't fish. |

[7] Lists others who have lived in the house & may have been affected by it.

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| 19 | 31 | 11 | Personal Privacy / Ex. 6 | AA | Pink Hill Duplin | ? | 7/1 mile | Aerial photo looks like 7 CAFOS - at least 4 hogs farms.<br>Breathing difficulties.<br>Flies. Loss of use & enjoyment, no cookouts. |
| 20 | 18 | 12 | | AA | Rocky Point Pender | ? | 5/2 miles | Unescapable smell, gets in car. Coughing and draining of eyes. Interferes with church activities by forcing events inside.<br>Congregants feel under pressure not to speak out.<br>(Minister, Hill's Chapel Missionary Baptist Church, 2521 Little Kelly Road, Rocky Point).<br>Tried to complain to Pender County Health Dept. during one bad episod of odor in the church in 2006. Calls not returned. Not tried again b/c under impression they could not or would not do anything. |
| 22 | 25 | 12 | | AA | Rocky Point Pender | | 9/3 miles | Odors. Loss of use & enjoyment (e.g., can't go outside, use pool, open windows). Pays to have county water. Has allergies. Concern about # local cancer patients.<br>She attends Rev. Hick's Church just around corner from her house. Says church is surrounded by hog farms. Can't open windows at church or have events outside. |
| 23 | 20 | 13 | | AA | Warsaw Duplin | W | 8/1 mile | Wind/rain blow waste onto home.<br>Can't go outside.<br>Not hooked up to public water system, so buys bottled drinking water ($5-10 a week). Can't fish. |
| 24 | 22 | 14 | | AA | Warsaw Duplin | P | 10/2 miles | Personal Privacy / Ex. 6 lives on major road. Odor & particulates from trucks a primary concern. White vinyl siding & can see hog residue on it.<br>Spraying seems to be at night.<br>Can't open house windows. |

Deliberative Process / Ex. 5

Personal Privacy / Ex. 6 can barely breathe due to asthma that developed 20 years ago Personal Privacy / Ex. 6

[9] Exhibit 4 talks about Personal Privacy / Ex. 6

[10] Personal Privacy / Ex. 6

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | Personal Privacy / Ex. 6 | | | | | Has severe bronchitis/pneumonia.<br>Lowered house value and can't sell house. |
| 25 | 23 | 14 | | AA | Warsaw<br>Duplin | P | 10/2 miles | **10 hog trucks come through every day.**<br>Constant bad smell. Persistent cough developed since moving to house in 2009.<br>Can't open the house b/c of odors & idling truck fumes.<br>Loss of use & enjoyment, no clothes outside, can't grill outside or spend time outside.<br>Increased costs: Use air filters, paid to connect to county water because of poor quality well water. |
| 26 | 27 | 15 | | H | Magnolia<br>Duplin | W | 8/2 miles | ¼ mile of spray field. Spray every 2-3 weeks. Sludge disposal nearby. Trucks w/sludge, increasing noise, dust. Odor. Child has sinus issues. Uses well water but buys drinking & cooking water $10-15 per week. Close windows<br>REACH organizer. |
| 26 | 35 | 16 | | AA | Clinton<br>Sampson | ? | 14/3 miles[11] | Spray field & hog house across the street & in in woods behind house. Sprays 2-3 times per week. Spray field waste on car.<br>Loss of use & enjoyment, rarely lets child go outside. |
| 34 | 21 | 17 | | AA | Clinton<br>Sampson | W | 2/? miles | Has issues with well water. Use Pur water filter & replaces the filter monthly. Well water would "fizzle." Ice has an "eggy" smell. Water often brown. Bad smell attracts bugs. Embarrassment.<br>Recently diagnosed with Conversion Disorder (Mayo Clinic definition: Conversion disorder, also called functional neurological symptom disorder, is a condition in which you show psychological stress in physical ways.) |
| 36 | 26 | 17 | | H | Clinton<br>Sampson | ? | 7/? miles | Talks about events at prior location of Union High School in Clinton. High School has moved. Spray on cars in parking lot. Everyone in school smelled horrible. Clothing would smell and would stink up cars, buses and |

[11] Map show 3 mile radius, but also farther.

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | classrooms. Humiliating. Notices that fishing ponds appear unhealthy. Fish have abrasions/infections and are unable to eat.<br>NC EJ Network organizer.<br>**Personal Privacy / Ex. 6** |
| 28 | 36 | 18 | Personal Privacy / Ex. 6 | AA | Kenansville Duplin | P | 12/2 miles | Closest less than mile.<br>Loss of use & enjoyment (e.g., can't go outside, no clothes outside close windows, have cookouts, have to wear mask when hunting).<br>County water hook up since Hurricane Floyd when county official hooked everyone up to city water. Have well water access, but county doesn't want us to drink it, but won't tell us why.<br>Used to fish & hunt for food. No longer fish in or hunt near Stocking Head Creek & Cape Fear River b/c of contamination & dead pigs in water & fish with sores.<br>Increased coughing & high blood pressure. |
| 29 | 1<br>***4/12*** | 19 | | AA | Kenansville Duplin | P | 15/3 miles | Less than 1 mile. Spray gets on house and screens on the windows and doors. **Dead boxes on Spicer Road has bugs and vultures**. Lots of dead trucks.<br>Particularly bad when it is windy. Comes through air ducts. Has trouble breathing outside. Diagnosed with asthma and has to take inhaler every 3-4 hours and oral medication made worse by the hog facilities. Doctors 2 times per month. High blood pressure.<br>Loss of use & enjoyment (e.g., can't go outside, open windows, have cookouts).<br>Well-water is contaminated. County water is brown.<br>Increased costs. A/C cost $50-$275/month. County water $500 connection fee and $30-$45 per month, buys drinking water in 5-gallon drums.<br>Can't fish anymore due to contaminated water and ill fish. Feels the hog facilities affects him mentally/physically. |
| 30 | 3<br>***4/12*** | 20 | | AA | Turkey Sampson | ? | 10/3 miles | Animal waste gets on car and home. |

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | Personal Privacy / Ex. 6 | | | | | Loss of use & enjoyment: can't go outside, sit on porch, garden, no cookouts, caretaker for husband who has dementia & can't take him outside. Mosquitos and bugs attracted to spray smell.<br>Sinus headache, trouble breathing, itchy eyes. Prescribed breathing machine, asthma pump, runny nose, and eye drops to treat symptoms. Son has sinus problems and wears a respiratory mask to go outside & cannot cut grass.<br>Husband has diabetes, kidney disease, asthma, and dementia.<br>Increased costs: prescriptions & over the counter medications ($100), asthma pump, breathing machine, & inhalers, cannot afford some prescriptions or lawn service. Lawn service cheaper than doctor visit.<br>Trucks – live & dead animals.<br>Poultry farms nearby.<br>Can't afford to sell home because she can't afford to move.<br>Used to live at B & L Trailer Park in Warsaw. 3 hog farms within 1 mile including hog farm right behind it. |
| 31 | 6<br>***4/12*** | 21 | | ? | Warsaw<br>Duplin | | 5/1.5 miles | Several spray fields near house.<br>Loss of use & enjoyment (e.g., can't go outside, grandchildren can't play outside, open windows, no cookouts, can't go on porch,<br>Gagging, burns eyes, causes itching sensation on skin.<br>Increased costs: $120 electricity bill would be lower if could open windows. Husband has COPD which costs $16/month in medications and is made worse by the smell outside.<br>Trucks day & night, smell & noise. Has to pull over when driving & hog truck pulls up.<br>Can see haze in air, thinks from hog spray<br>Poultry facilities |
| TIER 2 | | | | | | | | |
| 32 | 5 | | Anonymous 1 | AA | Duplin | | No map | Odors. Spray 3 times per week. Loss of use & enjoyment, no outside entertaining, no walking. Mist in yard & on clothes. Switched from well water. Decreased property values. Watery eyes. |

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| 33 | 7 | | Personal Privacy / Ex. 6 | AA | Wallace Duplin | | ? Hard to tell | Cost for county water. Odors, flies. Loss of use & enjoyment, no cookouts, can't sit on our porch. Windows closed. Use clothes dryer. Has to mow lawn twice a week b/c of nutrients from sprayers. Decreased property values. Can't sell or rent properties. |
| 35 | 24 | | | AA | Roseboro Sampson | ? | 3/1 miles | Hog farms directly north & south on Bass Lake Road. 3 w/in 1 mile & 7 w/in 3 miles.<br>High blood pressure, thyroid issues, heart conditions, uses oxygen machine. Nephew has regular sneezing/stuffy nose and allergies. Odor caused throat and mouth discomfort. Loss of use & enjoyment (e.g., can't hang-dry clothing or sit outside, no cookouts, flies). Can't fish. Can't have outdoor events at church (Union Grove Christ of Christ, Clinton) |
| 37 | 28 | | | AA | Kenansville Duplin | | 7/1.5 mile | Closest hog facility is 5-6 miles away (perhaps the 7 shown in photo are poultry). Odors. Spray. No longer fish. Stepping in waste outside facilities. Trucks – traffic & odors. Loss of use & enjoyment no walking. Dead boxes. |
| 38 | 32 | | | AA | Beulaville Duplin | ? | 4/1.5 miles | Many of impacts described are from when lived on Sarecta Rd. Odors from trucks, fluid from trucks, spray fields. Odors in clothes & hair. Laundromat costs. Bad well water smelled like rotten eggs. Current issues are general to the area, not current home. Thinks adding to allergies. Odors at church (Graham Chapel Church in Sarecta).<br>Brothers don't fish anymore green stuff grows in the water. Flies. Loss of use & enjoyment, no cookouts. Source of drinking not clear.<br>Drives to work from Beulaville, to Hallsville, thru Kenansvillle to Warsaw – hog farms all the way. |
| 39 | 2 ***4/12*** | | Anonymous 2 | AA | Warsaw | | 5/1 mile | Spray burns eyes. Can't eat outside or hang-dry clothing due to smell. Due to odor has allergies, headaches, uses humidifier and other health issues. Grandchildren couldn't play outside and had runny eyes and sneezing. Had to pay $500 plus monthly fees to connect to county water due to unsafe well-water. Lower property value. |
| 40 | 4 ***4/12*** | | Personal Privacy / Ex. 6 | AA | Riegelwood Columbus | | 2/2 miles | Lower property value. On city water but doesn't trust the water quality; water doesn't smell or look clean. Skeptical of drinking water. Doesn't garden due to fear of contaminated groundwater. |

| Map | Ex. # | Int. # | Name & Address | Race/ NO[1] | City/ County | $H_2O$[2] | # CAFOs/ Radius | **Concerns** (All complain of overwhelming stench/odor) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | East Bladen High School – odor was embarrassment 2004-2007 |
| | | | | | | | | |
| 41 | 6 | | Personal Privacy / Ex. 6 | W | | | | Riverkeeper/Waterkeeper Alliance. I have participated in water monitoring on Stocking Head Creek, on a 3½ mile stretch of water with more than 30 CAFOs. |
| 42 | 30 | | | | | | | NC EJ Network organizer. No personal statements. Summary descriptions of effects she has seen or heard about. |

**Deliberative Process / Ex. 5**

| Plaintiff | Address - Garysburg, NC | Impacts |
|---|---|---|
| Personal Privacy / Ex. 6 | | Personal Privacy / Ex. 6 Personal Privacy / Ex. 6 Opposed the farm development. Property adjoins hog buildings and spray fields on which 8 lagoons are located. Each of the 4 CAFOS near her home have continued to expand operations despite complaints and complaints to DENR. Subjected to nauseating odors and fumes from the Facility. The mists and fumes from the spraying waste comes onto her land and into her home. Flies and other pests. Loss in property value. **Water no longer fit to drink (prior to CAFOs it was) has had to switch to city water, incurring cost.** Trucks pass causing dust, noise, and odor. Episodes of nauseating smell can happen anytime of the year. Worse in the summer and heat. Even in the winter the smell can get very bad. |
| | | Inherited land from family, raised in area/lived entire life. Subjected to odors, flies, pests. Loss of enjoyment and use of property |
| | | Inherited land from family, raised in area/lived entire life. Subjected to odors, flies, pests. Loss of enjoyment and use of property |
| | | Personal Privacy / Ex. 6 unable to have gathering outdoors due to odor |
| | | Conducts his business from home, customers complain of the odors and trucks passing his business |
| | | Personal Privacy / Ex. 6 grew up on property, remembers a time before the nuisance. |
| | | Inherited land, before Farm 27-30 came into existence. Loss of enjoyment of her property, odor. |
| | | Purchased property in 1986. **Smell is worse in the rain, after it rains and it is cloudy the smell is very bad.** Flies, odor and nuisance. Farms 27-30 very close to property. |

| | |
|---|---|
| **Personal Privacy / Ex. 6** | **Personal Privacy / Ex. 6** Smell is worse in the rain, after it rains and it is cloudy the smell is very bad. Flies, odor and nuisance. Farms 27-30 very close to property. Has witnessed hog trucks leaking as they drive by |
| | Loss of use and enjoyment of her land. Inherited, family property for over a century. **The smell becomes worse when It rains. The odor comes onto their land when it rains and it is cloudy.** Trucks pass carrying live or dead hogs daily, additional odor, noise and dust. Witnessed liquid leaking out of hog trucks. Flies on property. **Concern over the quality of their water, they have called the health dep't but water has not been tested.** |
| | **Personal Privacy / Ex. 6** Has health problems and cannot be outside as the odor affects her sinus. **She purchases bottled water because the bad taste of the well water and her concerns about the health risks of drinking it.** Odor, flies, nuisance of hogs, loss of use and enjoyment of home. |
| | **Personal Privacy / Ex. 6** Odor, flies, loss of enjoyment and use of property. **She purchases bottled water because the bad taste of the well water and her concerns about the health risks of drinking it.** |
| | **Personal Privacy / Ex. 6** Same problems as his family, **additionally, suffers bronchitis and has problems breathing when the hog fumes and odor is bad.** |
| | **Personal Privacy / Ex. 6** Same problems with odor, flies, and nuisance from the Facility. **Additionally, experienced burning in his eyes after farm spraying and feeling sick to his stomach as a result of the odors and nuisance.** |
| | **Personal Privacy / Ex. 6** ame problems of odor, flies, and nuisance from the Facility. |
| | **Personal Privacy / Ex. 6** Same problems with odor, flies and nuisance fro mthe Facility. Additionally, problems breathing when the hog fumes and odors is bad. Her Allergies flare. |

| | |
|---|---|
| **Personal Privacy / Ex. 6** | Personal Privacy / Ex. 6 Same problems as family. **Fears runoff from farm will set into the water well. Problems breathing when the hog fumes are bad**. Loss of use and enjoyment of her home because of the odor, stench, flies and other nuisance from the hogs and waste. |
| | Personal Privacy / Ex. 6 Same problems with odor, flies, and nuisance from the Facility. |
| | Personal Privacy / Ex. 6 Same problems with odor, flies, and nuisance from the Facility. |
| | Personal Privacy / Ex. 6 Same problems with odors, flies, and nuisance from the Facility. Loss of use and enjoyment of her home. |
| | Personal Privacy / Ex. 6 Same problems with odors, flies, and nuisance from the Facility. Loss of use and enjoyment of her home. Trucks pass with live and dead hogs. **Fear that the runoff from the farm will get into the water well.** |
| | Personal Privacy / Ex. 6 Loss of use and enjoyment of home, odors, flies, and nuisance. Trucks with live or dead hogs pass house daily causing additional odor, noise and dust, has noticed liquid leaking out of trucks. |
| | Personal Privacy / Ex. 6 oss of use and enjoyment of home, odors, flies, and nuisance. Trucks with live or dead hogs pass house daily causing additional odor, noise and dust, has noticed liquid leaking out of trucks. |
| | Personal Privacy / Ex. 6 Same problems with odors, flies and nuisance from the facility as family. |
| | Personal Privacy / Ex. 6 family property, Same problems with odors, flies, and nuisance from the facility as family. |
| | Personal Privacy / Ex. 6 nherited the property from parents. Odors and flies have affected family reunions and gatherings, use and enjoyment of land. Personal Privacy / Ex. 6 **purchases bottled water because of the bad taste of the well water and concerns about the health risks of drinking it.** |

| | | |
|---|---|---|
| **Personal Privacy / Ex. 6** | | Inherited property. **Sometimes the foul fumes make it harder to breather, sometimes making him feel sick and nauseous. Hot or rainy/cloudy weather can make the smells worse.** Odors and trucks have hurt his use and enjoyment of his property. |
| | | Same problems with odor, flies, and nuisance from facility. |
| | | Inherited land from family. Odor is worse in the summer and when it rains. Hurts use and enjoyment of his property. Odors, flies and trucks. |
| | | Inherited property. **Sometimes the foul fumes make it harder to breather, sometimes making her feel sick and nauseous. Hot or breezy weather can make the smells worse.** Odors and trucks have hurt his use and enjoyment of his property. |
| | | Inherited family property 3 generations. Remembers before the facility was there, no bad smells or flies. Now, with facility and trucks there is odors, flies, and noise. |
| | | Similar harm from the hogs; odors and flies interfere with her use and enjoyment of the property. **Purchases bottled water because of the bad taste of the well water and her concerns about the health risks of drinking it.** |
| | | Odors and flies interfere with use and enjoyment of property. **Purchases bottled water because of the bad taste of the well water and concerns about the health risks of drinking it. Recalls having made a complaint to the County of the taste and color of the water with no one ever being sent out to test the water.** |
| | | Odors and flies interfere with use and enjoyment of property. Inherited land from family. Odors, stench, flies and other nuisance from the hogs and their waste. Children won't visit because of the stench and other nuisance from the hogs and their waste. |
| | | Same issues as **Personal Privacy / Ex. 6** Cannot garden anymore because of the stench. |

| | | |
|---|---|---|
| **Personal Privacy / Ex. 6** | | Parent's property of over 40 years. Episodes of large flies coming onto property and into house. Episodes of nauseating smell can happen at any time of the year, worse in the summer. Smell comes in through vents even with windows and door closed. Trucks go by carrying live and dead hogs. |
| | | Personal Privacy / Ex. 6 raised on Berry Scott Trail, and inherited the land from her parents. Harmed by the episodes of foul stench from the Facility located nearby. Has raised all her children and grandchildren in this area. Can recall when her children were able to run through fields and not **worry about breathing problems of being nauseated from the hog smell. She is afraid to drink the water and has to spend money to buy water.** |
| | | Same problems with the odor, flies, and nuisance as his wife. |
| | | Same issues of odor, flies, and nuisance from nearby facility as grandparents |
| | | Personal Privacy / Ex. 6 ived in area his entire life. Same problems with odor, flies, and nuisance as relatives. Remembers what it was like before the Facility was there, no bad smells and no flies. Loss of use and enjoyment of property. Flies are worse in the summer. |
| | | Same problems with odor, flies, nuisance from Farms 27-30 as her husband Rudolph Adams and family members |
| | | Personal Privacy / Ex. 6 ame problems with odor, flies, and nuisance from the Facility as her family members |
| | | Lived in area entire life. Personal Privacy / Ex. 6 Same problems with odor, flies, and nuisance from the Facility |
| | | Personal Privacy / Ex. 6 ived in area entire life, inherited the land, same problems with odor, flies, and nuisance from the facility. |

| | |
|---|---|
| Personal Privacy / Ex. 6 | Personal Privacy / Ex. 6 Same problems with odor, flies, and nuisance from the Facility as his family members. |
| | Personal Privacy / Ex. 6 Lived on the land entire life. Raise her own children on the land Personal Privacy / Ex. 6 Personal Privacy / Ex. 6 Episodes of odor, fumes, flies and dust make her air conditioning run up her electric bill. Forced to keep windows closed, stay indoors and by products to make home smell better. Embarrassed and humiliated to have her home smell of urine and feces and to have flies in her kitchen. |
| | Personal Privacy / Ex. 6 Lived on property her entire life. Same problems with the odor, flies, and nuisance from the facility as her family members. |
| | Purchased property in 1990 prior to the arrival of the hogs. Hurt her ability to use and enjoy her home because of odors, stench, flies, and other nuisance from the hogs and their waste. **Spray fields in view from her front door. Smell is stronger during spray. Afraid to drink water and has to spend money to buy bottled water. Episodes of flies coming onto her property and into house. Takes care of grandchildren and has to keep them indoors when the odor is strong as it causes her and the children breathing difficulties.** |

**EXHIBIT 1**

# CURRICULUM VITAE

## STEVEN BENNETT WING

### ADDRESS

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### EDUCATION

| | |
|---|---|
| University of North Carolina<br>Chapel Hill, NC | Ph.D. in Epidemiology<br>1983 |
| Duke University<br>Durham, NC | M.A. in Sociology<br>1980 |
| Vassar College<br>Poughkeepsie, NY | B.A. in Psychology<br>1975 |

### PROFESSIONAL EXPERIENCE

1995- Associate Professor, Department of Epidemiology, University of North Carolina, Chapel Hill.

1993 Visiting Professor, Department of Preventive Medicine, Federal University of Bahia, Salvador, Brazil.

1991-95 Assistant Professor, Department of Epidemiology, University of North Carolina, Chapel Hill.

1990 Visiting Professor, Faculty of Theoretical Medicine, University of Ulm, Germany.

1985-91 Research Assistant Professor, Department of Epidemiology, University of North Carolina.

1983-85 Post-doctoral Fellow, Department of Epidemiology, University of North Carolina, Chapel Hill.

## FELLOWSHIPS AND HONORS

| | |
|---|---|
| 2014 | John E. Larsh, Jr. Award for Mentorship, University of North Carolina School of Public Health |
| 2014 | Self-Determination Award, Black Workers for Justice |
| 2011 | Homer N. Calver Award, Environment Section, American Public Health Association |
| 2009 | International Society for Environmental Epidemiology Research Integrity Award |
| 2004 | Bernard G. Greenberg Alumni Endowment Award for Outstanding Teaching, Service and Practice, University of North Carolina School of Public Health |
| 2003 | Certificate of Honor, Alliance for Nuclear Accountability |
| 1997 | A Man Called Mathew Award, Concerned Citizens of Tillery and Land Loss Fund |
| 1993 | Brazilian National Research Council Visiting Professor Fellowship |
| 1983-85 | National Heart, Lung and Blood Institute Post-doctoral Traineeship |
| 1983 | Delta Omega, National Honorary Public Health Society |
| 1981-83 | National Heart, Lung and Blood Institute Pre-doctoral Traineeship |
| 1980-81 | United States Public Health Service Pre-doctoral Traineeship |
| 1978-80 | National Institute for General Medical Sciences Pre-doctoral Traineeship |

## PUBLICATIONS (*indicates first author was an advisee when the work was conducted)

### Book

Quigley D, Lowman A, Wing S (eds). Tortured Science: Health Studies, Ethics, and Nuclear Weapons in the United States. Amityville, NY: Baywood Press, 2012.

### Book Chapters

Wing S. Environmental injustice connects local food environments with global food production. In: Morland K (ed.) Local Food Environments: Food Access in America. Boca Raton, FL: CRC Press, 2014.

Wing S. Limits of Epidemiology. In: Brown P (ed.) Perspectives in Medical Sociology (4th edition). Long Grove, IL: Waveland Press, 2008. (from *Medicine and Global Survival*, 1994)

Morland K, Wing S. Food justice and health in communities of color. In: Bullard R (ed.) *Growing Smarter: Achieving Livable Communities, Environmental Justice, and Regional Equity*. Cambridge, MA: MIT Press, 2007.

Wing S. Environmental justice, science and public health. In: Goehl TJ (ed.) *Essays on the Future of Environmental Health Research: A Tribute to Dr. Kenneth Olden*. Researgh Triangle Park, NC: National Institue of Environmental Health Sciences, 2005.

Wing S. Social responsibility and research ethics in community driven studies of industrialized hog production. In: Brugge D, and Hynes HP (eds.) *Community Collaborative Research in Environmental Health: Studies in Science, Advocacy and Ethics*. Oxon, UK: Ashgate, 2005. (from *Envrionmental Health Perspectives*, 2002)

Wing, S. Whose epidemiology, whose health? In: Navarro V, Muntaner C (eds.) *Political and Economic Determinants of Population Health and Well-Being*. Amityville, NY: Baywood, 2004. (from *International Journal of Health Services*, 1998)

*Farquhar S, Wing S. Methodological and ethical considerations in community-driven environmental justice research: Two case studies from rural North Carolina. In: Minkler M, and Wallerstein N (eds.) *Community Based Participatory Research for Health*. Jossey-Bass, 2002.

Loomis D, Wing S. Theories of causation. In: Thomas JC and Weber DJ (eds.) *Epidemiologic Methods for the Study of Infectious Diseases*. New York: Oxford University Press, 2001.

Wing S. Limits of epidemiology. In: Kroll-Smith S, Brown P, Gunter VJ (eds.) *Illness and the Environment: A Reader in Contested Medicine*, New York: NY University Press, 2000. (from *Medicine and Global Survival*, 1994)

Richardson D, Wing S. Evidence of increasing sensitivity to radiation at older ages among workers at Oak Ridge National Laboratory. In: Schmitz-Feuerhake I, Schmidt M (eds.), *Radiation Exposures by Nuclear Facilities: Evidence of the Impact on Health*, Berlin: Gesellschaft für Strahlenschultz, 1998.

Wing S, Richardson D, Armstrong D, Crawford-Brown D. A re-analysis of cancer incidence near the Three Mile Island Nuclear Plant. In: Schmitz-Feuerhake I, Schmidt M (eds.), *Radiation Exposures by Nuclear Facilities: Evidence of the Impact on Health*, Berlin: Gesellschaft für Strahlenschultz, 1998.

Viel JF, Wing S, Hoffmann W. Environmental epidemiology, public health advocacy, and policy. In: Lawson A, Biggeri A, Boehning D, Lesaffre E, Viel JF, Bertollini R (eds.), *Disease Mapping and Risk Assessment for Public Health*, Chichester, England: Wiley & Sons, 1998.

Pearce NE, Matos E, Koivusalo M, Wing S. Industrialization and Health. In: Pearce NE, Matos E, Vainio H, Boffetta P, Kogevinas M (eds), *Occupational Cancer in Developing Countries*, Lyon: International Agency for Research on Cancer, 1994.

Wing S. Basics of radiation epidemiology. In: Burdman GM, Kaplan L (eds.), *Radiation Health Effects*, Seattle: Hanford Health Information Network, 1994.

Wing S. A review of recent findings on radiation and mortality at Oak Ridge National Laboratory. In Lengfelder E, Wendhausen H (eds.), *Neue Bewertung des Strahlenrisikos,* Proceedings of the International Society of Radiological Protection, pp 217-228, Munich: Medizin Verlag, 1993.

Kotelchuck M, Dodds J, Wing S and Kotch J. Societal trends that affect nutrition status and services for the maternal and child health populations. In Sharhaugh, C (ed) *Call to Action: Better Nutrition for Mothers, Children and Families*. Washington, DC: National Center for Education in Maternal and Child Health, 1991.

Wing S. Trends in society and public health: Looking towards the twenty-first century. In Kaufman M. (ed.) *Moving Towards the 21st Century: Empowering Nutritionists for Leadership in Public Health*. Proceedings of the Continuing Education Conference for the Association of State and Territorial Public Health Nutrition Directors and Association of Faculties of Graduate Programs in Public Health Nutrition, pp. 23-34, Chapel Hill, NC: Department of Nutrition, School of Public Health, University of North Carolina, 1989.

Tennis P, Wing S and Tyroler HA. Geographic variation among state economic areas in levels and declines of ischemic heart disease mortality in women of the U.S. Southeast, 1968-1978. In Eaker E.E. et al. (eds.) *Coronary Heart Disease in Women*, NY: Haymarket Doyma, 1987.

**Refereed Articles**

*Johnston J, Hoffman K, Wing S, Lowman A. Fish consumption patterns and mercury advisory knowledge among fishers in the Haw River basin. North Carolina Medical Journal, 2015 (forthcoming).

*Guidry VT, Gray CL, Lowman A, Hall D Jr, Wing S. Data quality from a longitudinal study of adolescent health at schools near industrial livestock facilities. Annals of Epidemiology, 25(7):532-538, doi: 10.1016/j.annepidem.2015.03.005. Epub 2015 Mar 18. PMID: 25935712, 2015.

Nadimpalli M, Rinsky JL, Wing S, Hall D, Stewart J, Larsen J, Nachman KE, Love DC, Pierce E, Pisanic N, Strelitz J, Harduar-Morano L, Heaney CD. Persistence of livestock-associated antibiotic-resistant Staphylococcus aureus among industrial hog operation workers in North Carolina over 14 days. Occupational and Environmental Medicine. 72:90-99, 2015. DOI: 10.1136/oemed-2014-102095

Heaney CD, Myers K, Wing S, Hall D, Baron D, Stewart JR. Source tracking swine fecal waste in surface water proximal to swine concentrated animal feeding operations. The Science of the Total Environment 511C:676-683, 2015. DOI: 10.1016/j.scitotenv.2014.12.062

Wing S, Lowman A, Keil A, Marshall SW. Odors from Sewage Sludge and Livestock: Associations with Self-Reported Health. Public Health Reports, 129:505-514, 2014.

*Schinasi L, Wing S, Augustino KL, Ramsey KM, Nobles DL, Richardson DB, Price LB, Aziz M, MacDonald PDM, Stewart JR. A case control study of environmental and occupational exposures associated with methicillin resistant *Staphylococcus aureus* nasal carriage in patients admitted to a rural tertiary care hospital in a high density swine region. Environmental Health, 13:54-66, 2014. DOI: 10.1186/1476-069X-13-54

*Guidry VT, Lowman A, Hall D, Baron D, Wing S. Challenges and benefits of conducting environmental justice research in a school setting. New Solutions, 24:153-70, 2014. DOI: 10.2190/NS.24.2.c

Campbell RL, Caldwell D, Hopkins B, Heaney CD, Wing S, Wilson SM, O'Shea S, Yeatts K. Integrating research and community organizing to address water and sanitation concerns in a community bordering a landfill. Journal of Environmental Health, 75(10):48-50, 2013, PMID: 23858665.

*Schinasi L, Wing S, MacDonald PDM, Richardson DB, Stewart JR, Augustino KL, Nobles DL, Ramsey KM. Medical and household characteristics associated with methicillin resistant staphylococcus aureus nasal carriage among patients admitted to a rural tertiary care hospital. PLoS ONE 8(8): e73595, 2013. doi:10.1371/journal.pone.0073595, 2013, PMID: 23991200

*Rinsky JL, Nadimpalli M, Wing S, Hall D, Baron D, Price LB, Larsen J, Stegger M, Stewart J, Heaney CD. Livestock-associated methicillin and multidrug resistant *Staphylococcus aureus* is present among industrial, not antibiotic-free livestock operation workers in North Carolina. PLoS ONE, 8(7): e67641, 2013. doi:10.1371/journal.pone.0067641, 2013. PMID: 23844044

Lowman A, McDonald MA, Wing S, Muhammad N. Land application of treated sewage sludge: Community health and environmental justice. Environmental Health Perspectives, 121:537-542, 2013. http://dx.doi.org/10.1289/ehp.1205470 PMID: 23562940

Richardson DB, Wing S, Keil A, Wolf S. Mortality among workers at Oak Ridge National Laboratory. Am J Ind Med. 2013. PMID: 23460075

*Heaney CD, Wing S, Wilson SM, Campbell RL, Caldwell D, Hopkins B, O'Shea S, Yeatts K. Public infrastructure disparities and the microbiological and chemical safety of drinking and surface water supplies in a community bordering a landfill. Journal of Environmental Health, 2013. PMID: 23858663

Hamra G, Richardson D, Maclehose R, Wing S. Integrating informative priors from experimental research with Bayesian methods: an example from radiation epidemiology. Epidemiology, 24:90-5, 2013. PMID: 23222512

Richardson DB, Wing S, Cole SR. Missing doses in the Life Span Study of Japanese atomic bomb survivors. American Journal of Epidemiology, 177:562-8, 2013. PMID: 23429722 (and response to Ozasa et al., 177:574-5. PMID: 23429721).

Wing S., Horton RA, Rose KM. Air pollution from industrial swine operations and blood pressure of neighboring residents. Environmental Health Perspectives. 121:92-96, 2013. PMID: 23111006

*Heaney CD, Sams E, Dufour AP, Brenner KP, Haugland RA, Chern E, Wing S, Marshall S, Love DC, Serre M, Noble R, Wade TJ. Fecal indicators in sand, sand contact, and risk of enteric illness among beachgoers. Epidemiology. 23(1):95-106, 2012. PMID: 22157306

*Heaney CD, Wing S, Campbell RL, Caldwell D, Hopkins B, Richardson D, Yeatts K. Relation between malodor, ambient hydrogen sulfide, and health in a community bordering a landfill. Environmental Research. 111:847-852, 2011.

Richardson D, Wing S. Evidence of confounding by smoking of associations between radiation and lung cancer mortality among workers at the Savannah River Site. American Journal of Industrial Medicine. 54(6):421-7, 2011.

*Keil A, Wing S, Lowman A. Suitability of public records for evaluating health effects of treated sewage sludge in North Carolina. North Carolina Medical Journal, 72:98-104, 2011.

Wing S, Richardson DB, Hoffmann W. Cancer risks near nuclear facilities: The importance of research design and explicit study hypotheses. Environmental Health Perspectives, 119:417-21, 2011.

*Stingone J, Wing S. Poultry-litter incineration as a source of energy: Reviewing the potential for impacts on environmental health and justice. New Solutions, 21:27-42, 2011.

*Schinasi L, Horton RA, Guidry VT, Wing S, Marshall SW, Morland KB. Air pollution, lung function, and physical symptoms in communities near concentrated swine-feeding operations. Epidemiology, 20:208-15, 2011.

Lowman A, Wing S, Crump C, MacDonald P, Heaney C, Aitken M. Public officials' perspectives on tracking and investigating symptoms reported near sewage sludge land application sites. Journal of Environmental Health, 73(6):14-20, 2011.

Angelon-Gaetz K, Richardson DB, Wing S. Inequalities in the nuclear age: Impact of race and gender on radiation exposure at the Savannah River Site (1951-1999). New Solutions. 20:195-210, 2010.

Wing S. Ethics for environmental health research: The case of the U.S. nuclear weapons industry. New Solutions. 20:179-187, 2010.

*Heaney CD, Sams E, Wing S, Marshall S, Brenner K, Dufour AP, Wade TJ. Contact with beach sand among beachgoers and risk of illness. American Journal of Epidemiology. 170:164-72, 2009.

*Horton RA, Wing S, Marshall SW, Brownley KA. Odor as a trigger of stress and negaive mood in neighbors of industrial hog operations. American Journal of Public Health. 99:S610-615, 2009.

*Schinasi L, Horton RA, Wing S. Data completeness and quality in a community-based and participatory epidemiologic study. Progress in Community Health Partnerships. 3:179-190, 2009.

Richardson DB, Sugiyama H, Wing S, Sakata R, Grant E, Shimizu Y, Nishi N, Geyer S, Soda M, Suyama A, Kasagi F, Kodama K. Positive associations between ionizing radiation and lymphoma mortality among men. American Journal of Epidemiology. 169(8):969-76, 2009.

Wing S, Horton R, Marshall S, Thu K, Tajik M, Schiffman S. Air pollution and odor in communities near industrial swine operations. Environmental Health Perspectives, 116:1362-1368, 2008.

Wing S, Horton R, Muhammad N, Grant G, Tajik M, Thu K. Integrating epidemiology, education, and organizing for environmental justice: Community health effects of industrial hog operations. American Journal of Public Health, 98:1390-1397, 2008.

*Tajik M, Muhammad N, Lowman A, Thu K, Wing S, Grant G. Impact of odor from industrial hog operations on daily living activities. New Solutions: A Journal of Occupational and Environmental Health Policy. 18:193-205, 2008.

Todd L, Puangthongthub S, Mottus K, Mihlan G, Wing S. Health survey of workers exposed to mixed solvent and ergonomic hazards in footwear and equipment factory workers in Thailand. Annals of Occupational Hygiene. 52:195-205, 2008.

*Norton J, Wing S, Lipscomb HJ, Kaufman JS, Marshall SW, Cravey AJ. Race, wealth, and solid waste facilities in North Carolina. Environmental Health Perspectives. 115:1344-1350, 2007.

Richardson DB, Wing S. Leukemia mortality among workers at the Savannah River Site. American Journal of Epidemiology, 166:1015-1022, 2007.

Richardson DB, Wing S, Wolf S. Mortality among workers at the Savannah River Site. American Journal of Industrial Medicine. 50:881-891, 2007.

Resnik DB, Wing S. What can we learn from CHEERS? American Journal of Public Health. 97:414-418, 2007.

Donham K, Wing S, Osterberg D, Flora J, Hodne C, Thu K. Community health and socioeconomic issues surrounding concentrated animal feeding operations. Environmental Health Perspectives. 115:317-320, 2007.

Griffith M, Tajik M, Wing S. Patterns of agricultural pesticide use in relation to socioeconomic characteristics of the population in the rural US South. International Journal of Health Services. 37:259-277, 2007.

Richardson DB, Wing S, Daniels RD. Evaluation of external radiation dosimetry records at the Savannah River Site, 1951-1989. Journal of Exposure Science and Environmental Epidemiology. 17:13-24, 2007.

*Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. Asthma symptoms among adolescents attending public schools located near confined swine feeding operations. Pediatrics, 118:e66-e75, 2006.

*Mirabelli MC, Wing S. Proximity to pulp and paper mills and wheezing symptoms among adolescents in North Carolina. Environmental Research, 102: 96-100, 2006.

Richardson D, Wing S. Lung cancer mortality among workers at a nuclear materials fabrication plant. American Journal of Industrial Medicine, 49:102-111, 2006.

Morland K, Diez Roux A, Wing S. Supermarkets, Other Food Stores and Obesity: the Atherosclerosis Risk in Communities Study. *American Journal of Preventive Medicine*, 30:333-339, 2006.

*Mirabelli MC, Wing S, Marshall SW, Wilcosky TC. Race, poverty, and potential exposure of middle school students to air emissions from confined swine feeding operations. *Environmental Health Perspectives*, 114:591-596, 2006.

Lipscomb HJ, Loomis D, McDonald MA, Argue R, Wing S. A conceptual model of work and health disparities in the United States. International Journal of Health Services, 36:25-50, 2006.

Lipscomb HJ, Argue R, McDonald MA, Dement JA, Epling CA, James T, Wing S, Loomis D. Exploration of work and health disparities among black women employed in poultry processing in the rural South. *Environmental Health Perspectives*, 113:1833-1840, 2005

Richardson DB, Wing S, Schroeder J, Schmitz-Feuerhake I, Hoffmann W. Ionizing radiation and chronic lymphocytic leukemia. *Environmental Health Perspectives*, 113:1-5 2005.

Wing S, Richardson D. Age at exposure to ionising radiation and cancer mortality among Hanford workers: follow up through 1994. *Occupational and Environmental Medicine*, 62:465-472, 2005.

*Avery R, Wing S, Marshall S, Schiffman S. Perceived odor from industrial hog operations and suppression of mucosal immune function in nearby residents. *Archives of Environmental Health*, 59:101-108, 2004.

Richardson D, Wing S, Steenland K, McKelvey W. Time-related aspects of the healthy worker survivor effect. *Annals of Epidemiology*, 14:633-639, 2004.

Richardson DB, Wing S, Lorey F, Hertz-Piccioto I. Adult hemoglobin levels at birth and risk of sudden infant death syndrome. *Archives of Pediatric and Adoloscent Medicine*, 158:366-371, 2004.

Massing MW, Rosamond WD, Wing SB, Suchindran CM, Kaplan BH, Tyroler HA. Income, income inequality, and cardiovascular disease mortality: Relations among county populations of the United States, 1985 to 1994. *Southern Medical Journal*, 97:475-84, 2004.

Wing S, Richardson D, Wolf S, Mihlan G. Plutonium-related work and cause-specific mortality at the United States Department of Energy Hanford Site. *American Journal of Industrial Medicine*, 24:153-164, 2004.

Wing S. Objectivity and ethics in environmental health science. *Environmental Health Perspectives*, 111:1809-1818, 2003.

*Morland K, Wing S, Diez Roux A. The contextual effect of the local food environment on residents' diets: the Atherosclerosis Risk in Communities Study. *American Journal of Public Health*, 92:1761-1767, 2002.

*Wilson S, Howell F, Wing S, Sobsey M. Environmental injustice and the Mississippi hog industry. *Environmental Health Perspectives,* 110 (Supplement 2):195-201, 2002.

Wing, S. Social responsibility and research ethics in community driven studies of industrialized hog production. *Environmental Health Perspectives*, 110:437-444, 2002.

Wing S, Freedman S, Band L. The potential impact of flooding on confined animal feeding operations in eastern North Carolina. *Environmental Health Perspectives*, 110:387-391, 2002.

*Morland K, Wing S, Diez Roux A, Poole C. Neighborhood characteristics associated with the location of food stores and food service places. *American Journal of Preventive Medicine*, 22:23-29, 2002.

Richardson D, Wing S, Hoffmann W. Cancer risk from low level ionizing radiation: the role of age at exposure. *Occupational Medicine State of the Art Reviews*, 16:191-218, 2001.

Wing S. The influence of age at exposure to radiation on cancer risk in humans (extended abstract). *Radiation Research*, 154:732-733, 2000.

Cole D, Todd L, Wing S. Concentrated swine feeding operations and public health: A review of occupational and community health effects. *Environmental Health Perspectives*, 108:685-699, 2000.

Wing S, Richardson D, Wolf S, Mihlan G, Crawford-Brown D, Wood J. A case-control study of multiple myeloma at four nuclear facilities. *Annals of Epidemiology*, 10:144-153, 2000.

*St. George DM, Wing SB, Lewis DL. Geographic and temporal patterns of toxic industrial chemicals released in North Carolina, 1988-1994. *North Carolina Medical Journal*, 61:396-400, 2000.

Richardson D, Wing S, Watson J, Wolf S. Evaluation of annual external radiation doses at or near minimum detection levels of dosimeters at the Hanford nuclear facility. *Journal of Exposure Analysis and Environmental Epidemiology*, 10:27-35, 2000.

Wing S, Cole D, Grant G. Environmental injustice in North Carolina's hog industry. *Environmental Health Perspectives*, 108:225-231, 2000.

Wing S, Wolf S. Intensive livestock operations, health, and quality of life among eastern North Carolina residents. *Environmental Health Perspectives*, 108:233-238, 2000.

Santana VS, Loomis D, Wing S. Bahia-Carolina program in environmental and occupational health: A North-South partnership for workplace and environmental justice. *International Journal of Occupational and Environmental Health*, 5:218-222, 1999.

*Richardson DB, Wing S. Greater sensitivity to radiation exposures at older ages among workers at Oak Ridge National Laboratory: Follow-up through 1990. *International Journal of Epidemiology*, 28:428-436, 1999.

*Richardson D, Wing S. Radiation and mortality among workers at Oak Ridge National Laboratory: Positive associations for doses received at older ages. *Environmental Health Perspectives*, 107:649-656, 1999.

Wing S, Richardson D, Stewart A. The relevance of occupational epidemiology to radiation protection standards. *New Solutions: A Journal of Occupational and Environmental Health Policy*, 9:133-151, 1999.

Richardson D, Wing S, Watson J, Wolf S. Missing annual external radiation dosimetry data among Hanford workers. *Journal of Exposure Analysis and Environmental Epidemiology*, 9:575-585, 1999.

*Richardson D, Wing S. Methods for investigating age differences in the effects of prolonged exposures. *American Journal of Industrial Medicine*, 33:123-130, 1998.

Wing S. Whose epidemiology, whose health? *International Journal of Health Services*, 28:241-252, 1998.

Wing S, Richardson D, Armstrong D, Crawford-Brown D. A reevaluation of cancer incidence near the Three Mile Island nuclear plant: The collision of evidence and assumptions. *Environmental Health Perspectives*, 105:52-57, 1997.

Frome EL, Cragle DL, Watkins JP, Wing S, Shy CM, Tankersley WG, West CM. A mortality study of employees of the nuclear industry in Oak Ridge, Tennessee. *Radiation Research*, 148:64-80, 1997.

Wood J, Richardson D, Wing S. A simple program to create exact person-time data in cohort analyses. *International Journal of Epidemiology*, 26:395-399, 1997.

Barnett E, Strogatz D, Armstrong D, Wing S. Urbanization and coronary heart disease mortality among African Americans in the US South. *Journal of Epidemiology and Community Health*, 50:252-257, 1996.

*Armstrong D, Wing S, Tyroler HA. Race differences in estimates of sudden coronary heart disease mortality, 1980-88: The impact of ill-defined death. *Journal of Clinical Epidemiology*, 49:1247-51, 1996.

Wing S, Grant G, Green M, Stewart C. Community based collaboration for environmental justice: South-east Halifax environmental reawakening. *Environment and Urbanization*, 8:129-140, 1996.

Casper ML, Wing S, Anda RF, Knowles M, Pollard RA. The shifting stroke belt: Changes in the geographic pattern of stroke mortality in the United States, 1962-1988. *Stroke* 26:755-760, 1995.

*Armstrong DL, Wing SB, Tyroler HA. United States mortality from ill-defined causes, 1968-1988: Potential effects on heart disease mortality trends. *International Journal of Epidemiology*, 24:522-527, 1995.

Wing S, West CM, Wood J, Tankersley W. Recording of external radiation exposures at Oak Ridge National Laboratory: Implications for epidemiological studies. *Journal of Exposure Assessment and Environmental Epidemiology*, 4:83-93, 1994.

Wing S. Limits of epidemiology. *Medicine and Global Survival*. 1:74-86, 1994.

*Millard P, Cegielski JP, Wing S, Silver A. Tuberculosis incidence trends and changes in incidence trends in North and South Carolina, 1980-1992. *Journal of Rural Health* 10:226-236, 1994.

Wing S, Shy CM, Wood JL, Wolf S, Cragle DL, Tankersley W, Frome EL. Job factors, radiation and cancer mortality at Oak Ridge National Laboratory: Follow-up through 1984. *American Journal of Industrial Medicine* 23:265-279, 1993.

Tyroler HA, Wing S, Knowles M. Increasing inequality in CHD mortality in relation to educational achievement profile of places of residence, US. 1962-87. *Annals of Epidemiology* 3:S51-S54, 1993.

Wing S, Barnett E, Casper M, Tyroler HA. Geographic and socioeconomic variation in the onset of decline of coronary heart disease mortality in white women. *American Journal of Public Health* 82:204-209, 1992.

*Carter L, Walton S, Knowles M, Wing S, Tyroler HA. Social inequality of stroke mortality among US Black populations, 1968-1987. *Ethnicity and Disease* 2:343-350, 1992.

*Casper M, Wing S, Strogatz D, Davis CE, Tyroler HA. Antihypertensive pharmacotherapy and U.S. declines in stroke mortality, 1962 to 1980. *American Journal of Public Health* 82:1600-1606, 1992.

Wing S, Shy C, Wood J, Wolf S, Cragle D and Frome E. Mortality among workers at Oak Ridge National Laboratory: Evidence of radiation effects in follow-up through 1984. *Journal of the American Medical Association* 265:1397-1402, 1991.

Manton K, Stallard E and Wing S. Analyses of Black and White differentials in the age trajectory of mortality in two closed cohort studies. *Statistics in Medicine* 10:1043-1059, 1991.

*Casper M, Wing S and Strogatz D. Changes in the magnitude of Black-White differences in stroke mortality by community occupational structure. *Journal of Epidemiology and Community Health* 45:302-306, 1991.

Amandus HE, Shy C, Wing S, Blair A, Heineman EF. Silicosis and lung cancer in North Carolina dusty trades workers. *American Journal of Industrial Medicine* 20:57-70, 1991.

Sorel JE, Heiss G, Tyroler HA, Davis WB, Wing SB, Ragland DR. Black-White differences in blood pressure among participants in NHANESII: The contribution of blood lead. *Epidemiology* 2:348-52, 1991.

Wing S, Casper M, Davis WB, Hayes C, Riggan W and Tyroler H.A. Trends in the geographic inequality of cardiovascular disease mortality in the United States,1962-1982. *Social Science and Medicine* 30:261-266, 1990.

Loomis D, Wing S. Is molecular epidemiology a germ theory for the late twentieth century? *International Journal of Epidemiology* 19(1):1-3, 1990.

Wing S, Casper M, Riggan W, Hayes C and Tyroler HA. Socioenvironmental characteristics associated with the onset of decline of ischemic heart disease mortality in the United States. *American Journal of Public Health*, 78:923-26, 1988.

Wing S. Social inequalities in the decline of coronary mortality (editorial). *American Journal of Public Health* 78:1415-16, 1988.

Wing S, Casper M, Davis WB, Pellom A, Riggan W and Tyroler HA. Stroke mortality maps: United States whites aged 35-74, 1962-1982. *Stroke* 19:1507-1513, 1988.

Wilcosky T and Wing S. The healthy worker effect: Selection of workers and work forces. *Scandinavian Journal of Work, Environment and Health* 13:70-72, 1987.

James SA, Strogatz DS, Wing SB and Ramsey DL. Socioeconomic status, John Henryism, and hypertension in blacks and whites. *American Journal of Epidemiology*, 126:664-73, 1987.

Wing S, Dargent P, Casper M, Tyroler HA, Riggan W and Hayes CG. The changing association of community occupational structure and ischemic heart disease mortality in the United States. *The Lancet*, ii:1067-70, 1987.

Logue EE and Wing S. Life-table methods for detecting age-risk factor interactions in long-term follow-up studies. *Journal of Chronic Diseases*, 39:709-717, 1986.

Wing S, Hayes C, Heiss G, John E, Knowles M, Riggan W and Tyroler HA. Geographic variation in the onset of decline of ischemic heart disease mortality in the U.S. *American Journal of Public Health*, 76:1404-1408, 1986.

Wing S, Manton KG, Stallard E, Hames CG and Tyroler HA. The black/white mortality crossover: Investigation in a community-based study. *Journal of Gerontology* 40:78-84, 1985.

Wing S, Tyroler HA and Manton KG. The participant effect: Mortality in a community-based study compared to vital statistics. *Journal of Chronic Diseases* 38:135-144, 1985.

Tyroler HA, Knowles M, Wing S, Logue EE, Davis CE, Heiss G, Heyden S and Hames CG. Ischemic heart disease risk factors and twenty-year mortality in middle-age Evans County black males. *American Heart Journal* 108:738-746 (supplement), 1984.

Wing S. The role of medicine in the decline of hypertension-related mortality. *International Journal of Health Services* 14:649-666, 1984.

Wing S and Manton KG. The contribution of hypertension to mortality in the US: 1968, 1977. *American Journal of Public Health* 73:140-144, 1983.

Wing S, Aubert R, Hansen J, Hames CG, Slome C and Tyroler HA. Isolated systolic hypertension in Evans Co. I. Prevalence and screening considerations. *Journal of Chronic Diseases* 35:735-742, 1982.

Wing S and Manton KG. A multiple cause of death analysis of hypertension-related mortality in North Carolina, 1968-1977. *American Journal of Public Health* 71:823-830, 1981.

Manton KG, Poss SS and Wing S. The black/white mortality crossover: Investigation from the perspective of the components of aging. *The Gerontologist*, 19:291-300, 1979.

**Unrefereed Works**

Letters, invited commentaries and book review in peer-reviewed journals

Soskolne CL, Al-Delaimy WK, Burns K, Finch MR, Gaudino JA Jr, Lanphear B, Oremus M, Phillips L, Ruff K, Weiss SH, Wing S. Competing interests in epidemiology. British Medical Journal, 350:g7744, doi: 10.1136/bmj.g7744. PMID: 25569167, 2015.

Richardson DB, Wing S, Cole SR. 2013. Richardson et al. Respond to "missing doses in the life span study". American Journal of Epidemiology 177:574-575.

Campbell RL, Caldwell D, Hopkins B, Heaney CD, Wing S, Wilson SM, O'Shea S, Yeatts K. Integrating research and community organizing to address water and sanitation concerns in a community bordering a landfill. J Environ Health. 2013 Jun;75(10):48-50. PMID: 23858665

Richardson DB, Wing S. Re: solid cancer incidence in atomic bomb survivors exposed in utero or as young children. J Natl Cancer Inst. 100:1482-3, 2008.

Richardson D, Wing S. Are A-bomb survivor studies an appropriate basis for nuclear worker compensation? *Environmental Health Perspectives*, 111:A748, 2003.

Richardson D, Wing S. Studies of radiation-cancer associations among workers at Oak Ridge National Laboratory. *Technology*, 9:141-143, 2003.

Wing S, Richardson D. Use of A-bomb survivor studies as a basis for nuclear worker compensation. *Environmental Health Perspectives*, 110:A739, 2002.

Wing, S. (Review) Challenging Inequalities in Health: From Ethics to Action. *New England Journal of Medicine*, 345:1857-1858, 2001.

Wing S, Richardson D. Collision of evidence and assumptions: TMI Deja View. *Environmental Health Perspectives*, 109: 496, 2001.

Wing S, Richardson D, Armstrong D. Reply to comments on "A Reevaluation of Cancer Incidence Near the Three Mile Island." *Environmental Health Perspectives*, 105:266-268, 1997.

Wing S, Richardson D, Armstrong D. Response: Science, public health and objectivity: Research into the accident at Three Mile Island. *Environmental Health Perspectives*, 105:567-570, 1997.

Wing S, Richardson D, Armstrong D. Low-level radiation harmed humans near Three Mile Island: Response. *Environmental Health Perspectives*, 105:787, 1997.

Casper M, Wing S, Strogatz D, Davis CE, Tyroler HA. Stroke mortality trends and antihypertensive drug use (letter in reply to Smith and Pinckney). *American Journal of Public Health* 83:1643, 1993.

Wing S, Shy CM, Wood JL, Cragle D. Radiation dosage estimation and health risk (letter in reply to Maienschein and Peele). *Journal of the American Medical Association* 267:929-930, 1992.

Wing S, Shy CM, Wood JL, Wolf S, Cragle D, Frome EL. Mortality of workers at the Oak Ridge National Laboratory, (letter in reply to letter by Gilbert and editorial by Prichard). *Health Physics* 62:261-264, 1992.

Wing S, Shy C. Public health effects of occupational and environmental radiation exposure (letter in reply to letters by Brown; Greenspan; and Marshall and Baker; and editorial by Hendee). *Journal of the American Medical Association* 266:653-4, 1991.

Monographs, non-refereed journal articles, and other published works

Wing S. When research turns to sludge. Academe 96(6):22-24, 2010.

Wing S. Raising animals and rising threats. Raleigh News & Observer, Raleigh, NC, June 24, 2009.

Wing S. Justica ambiental, ciencia y salud pública. *Salud y Medio Ambiente*, 37:35-45, 2009. (translation of 2005 article from *Essays on the Future of Environmental Health Research*)

Aitken M, Crump C, Heaney C, Lowman A, McDonald P, Wing S. Epidemiologic Surveillance and Investigation of Symptoms of Illness Reported By Neighbors of Biosolids Land Application Sites. Report to Water Environment Research Foundation, 2008.

Wing S, Warren C. Big money and public health. News & Observer, Raleigh, NC, March 7, 2008.

Wing S, Schinasi L. Public health preparedness: Social control or social justice? South Atlantic Quarterly, 106:789-804, 2007.

Grant G, Wing S. The North Carolina Hog Roundtable. Race, Poverty & the Environment, Winter, 2004, http://www.urbanhabitat.org/node/164.

Wing, S. Community-driven epidemiology and environmental justice: A course at The University of North Carolina. The Networker: Newsletter of the Science and Environmental Health Network 5(5), October, 2000, www.sehn.org.

Richardson D, Wing S, Stewart A. Epidemiologic Studies of the Effects of Exposure to Ionizing Radiation. Ministry of Finance and Energy, Schleswig-Holstein, Germany, 1997.

Wing S, Richardson D. Material Living Conditions and Health in the United States, Canada and Western Europe. Research in Public Health Technical Papers, Series 19, Pan American Health Organization, Washington, DC, 2000.

Wing S, Richardson D. Occupational Health Studies at Los Alamos National Laboratory. In, New Mexico's Right to Know: The Impacts of LANL Operations on Public Health and the Environment, Concerned Citizens for Nuclear Safety, 2002, http://www.nuclearactive.org.

Wing S. Evaluation of the US Agency for Toxic Substances and Disease Registry's Public Health Assessment of Laurence Livermore National Laboratory. Prepared for Tri-Valley CAREs, Western States Legal Foundation and the San Francisco Bay Area Physicians for Social Responsibility under their "Health Consultation on the Impact of Two Major Tritium Accidents at Livermore Lab: An Independent Scientific Analysis," 2002.

Invited scientific lectures, seminars and testimony

Health inequalities, industrial agriculture, and the Civil Rights Act of 1964. Joe G. Lopez Lectureship on Racial Disparities in Health, Boston University School of Public Health, October 29, 2014.

Reification of chance in epidemiology and society. Department of Public Health Sciences Medical University of South Carolina, March 21, 2014.

Epidemiologic studies of radiation releases from nuclear facilities. New York Academy of Medicine, March 11, 2013.

Poverty, health, and industrial hog production. Committee to Advance Science Writing, New Horizons in Science, Raleigh, NC October 28, 2012.

Social and ecological dimensions of the food supply: health inequalities. Exploring the True Costs of Food, Institute of Medicine, April 23-24, 2012

Environmental health and the corporate-government alliance. Homer N. Calver Award Lecture, Environment Section, American Public Health Association annual meeting, Washington, DC, October 31, 2011.

Cancer risks near nuclear facilities: The importance of research design and explicit study hypotheses. National Academy of Sciences Committee on Analysis of Cancer Risks Near Nuclear Facilities, Atlanta, GA, May 23, 2011.

Public health research and the environmental justice movement. Doris Slesinger Lecture, Department of Community and Environmental Sociology and Department of Family Medicine. University of Wisconsin, Madison, March 30, 2011.

Radiation health effects: The case of plutonium. Rocky Mountain Peace and Justice Center and Department of Environmental Studies, Naropa University, Boulder, CO, March 31, 2011.

Air pollution from swine CAFOs and health of neighboring communities. Departmental Seminar, Department of Environmental Health, Johns Hopkins University. December 8, 2010.

The scope of epidemiology. Expert workshop on cancer in Basrah, Iraq. Istanbul, November 17, 2010.

Swine CAFOs, air pollution, and community health. Evaluating the Health Effects to Local Communities of Confined Animal Feeding Operations (CAFOs) Workshop. NC State University, November 11, 2010.

Developing testable hypotheses for cancer risks near nuclear power facilities. Nuclear and Radiation Studies Board, National Academy of Sciences, Washington, DC, April 26, 2010.

What kind of action comes from research? (with Gary Grant). Partnerships for Environmental Public Health Program Meeting, Research Triangle Park, NC, April 26, 2010.

Research and Data Needs for Assessing and Addressing Disproportionate Environmental Health Impacts Among Minority and Disadvantaged Populations. (Panelist) US Environmental Protection Agency, Strengthening Environmental Justice and Decision Making: A Symposium on the Science of Disproportionate Environmental Health Impacts. Washington DC, March 17 - 19, 2010

Environment, disasters, and health disparities. Minority Health Conference, University of North Carolina, Chapel Hill, February 27, 2009.

Cancer around nuclear power plants: Collision of evidence and assumptions, déjà vu. Meeting of the Society for Radiation Protection, Virchow Clinic Campus, Medical University of Berlin, September 28, 2008.

Assumptions, evidence, and causal reasoning in radiation epidemiology. Annual meeting of the German Society for Epidemiology, Bielefeld, Germany, September 27, 2008.

Improving environmental health science through community-driven research. University of Texas Medical Branch Sealy Center for Environmental Health and Medicine, Galveston, TX, March 31, 2008 (with Gary Grant).

Integrating Epidemiology with Community Action for Environmental Justice. Department of Environmental Health Sciences, UNC Chapel Hill, March 19, 2008.

Whose science, whose environmental health? Fronteers in Environmental Science Series, National Institute of Environmental Health Sciences, Research Triangle Park, NC, September 14, 2007.

Changing views of the biological effects of low-level ionizing radiation. Royal Society of Medicine, London, International Physicians for Prevention of Nuclear War, October 3, 2007.

Research partnerships for public health and environmental justice. Jensen Lecture, Duke University Department of Sociology, April 7, 2006

Public health preparedness, disease control, and social justice. Rock Ethics Institute, Health as a Human Right Lecture, Pennsylvania State University, October 17, 2005.

Health disparities. American Medical Association – Medical Student Section Region 4 Annual Meeting, Duke University Medical Center, March 5, 2005.

Genes, justice, and racial inequalities in health. 5$^{th}$ Annual Minority Health Leadership Summit, School of Public Health, University of Pittsburgh, January 13, 2005.

Quantitative methods in the epidemiology of environmental injustice: Examples from eastern North Carolina. Math Departmental Seminar, East Carolina University, December 1, 2004.

Improving environmental health science through partnerships in communities affected by environmental injustice. The Science of Environmental Justice Working Conference, US Environmental Protection Agency, Boston University, May 25, 2004.

North Carolina swine production, health and environmental justice (with Gary R. Grant). The Science of Environmental Justice Working Conference, US Environmental Protection Agency, Boston University, May 26, 2004.

Environmental injustice in eastern North Carolina: Corporate hogs and guerrilla epidemiology. Department of Epidemiology and Biostatistics seminar, College of Public Health, University of South Florida, December 3, 2003.

Inequality and inequity: the broader causes of health disparities. Panel presentation, Mending the Health Care Divide: Eliminating Disparities in Access for Minority and Low Income Communities. University of North Carolina School of Law, UNC Center for Civil Rights and UNC School of Public Health, Chapel Hill, NC, November 1, 2003.

The "chilling effect" on environmental health research: Industry tactics and institutional disincentives. Conflicted Science: Corporate Influence on Scientific Research and Science-Based Policy, conference sponsored by the Center for Science in the Public Interest's Integrity in Science Project. July 11, 2003 Washington, DC.

Science, objectivity and ethics in environmental health. Dialogues for Improving Research Ethics in Envrionmental and Public Health (Conference), Brown University, Providence, RI, May 31, 2003.

Methodology and ethics in epidemiology of environmental justice: Industrial hogs and guerrilla epidemiology. Departmental Seminar, Department of Epidemiology, School of Public Health, State University of New York, Albany, NC, April 11, 2003.

Health disparities, research ethics and environmental epidemiology. Epidemiology Branch, National Institute of Environmental Health Sciences, May 13, 2002.

Health impacts, Risks and Response: Nuclear Terrorism in the Triangle, A Public Forum to Address Emergency Planning and Risk Minimization, sponsored by Orange and Chatham County Boards of Commissioners, William Friday Center, Chapel Hill, NC, May 2, 2002.

Bioterrorism preparedness and health disparities, The New War Economy, a teach-in sponsored by the UNC-CH Progressive Faculty Network, Chapel Hill, NC, April 19, 2002.

The role of epidemiology in evaluating releases from nuclear facilities: Insights from the work of Alice Stewart. The Alice Stewart Lecture, 16th Low Level Radiation and Health Conference, Dublin Institute of Technology, Ireland, June 21, 2002.

Health effects of low level radiation, Physicians for Social Responsibility, Los Angeles, March 11, 2002.

Community based environmental health research, Morehouse College and Southeast Community Research Center, Atlanta, GA, November 10, 2001.

Pork production, public health and environmental justice. Department of Environmental Health, University of Cincinnati, Departmental Seminar, May 23, 2001.

Subcommittee on Energy and Environment of the Committee on Science, United States House of Representatives, "Reexamining the Scientific Basis for the Linear No-Threshold Model of Low-dose Radiation," July 18, 2000. Published testimony: Serial No. 106-98, pages 101-115 and 123-138. Government Printing Office, Washington, DC: 2001.

Human Health, Sustainable Hog Farming Summit, New Bern, NC, January 11, 2001.

Integrating research, teaching and practice in environmental justice. Departmental Seminar, Department of Sociology and Anthropology, NC State University, December 1, 2000.

Community public health needs and industrial animal production research. American Public Health Association Annual Meeting, Boston, MA, November 14, 2000.

Social inequalities in occupational and environmental health. Brazilian Congress of Epidemiology Annual Meeting, Salvador, Bahia, Brazil, September 1, 2000.

The influence of age at exposure to radiation on cancer risk in humans. American Statistical Association Conference on Radiation and Health, Park City, UT, June 27, 2000.

National Academy of Sciences, Committee on the Biological Effects of Ionizing Radiation (BEIR VII). "The Relevance of Occupational Epidemiology to Radiation Protection Standards," Washington DC, June 13, 2000.

Radiation and Rocky Flats: Risks to workers and the public, Rocky Mountain Peace and Justice Center, Boulder, CO, June 24, 2000.

Public health and intensive hog production in North Carolina. Research Triangle Institute, June 9, 2000.

Low level radiation and health. Brookhaven National Laboratory, June 5, 2000.

Research to action: Getting our work used! Community-Based Research for Environmental Justice: Workshops from the Field 2000 Training and Conference, Rutgers University, Newark, NJ, May 21, 2000.

Health effects of nuclear weapons production, Our Nuclear Future, Conference held prior to the United Nations Disarmament Conference, United Nations Plaza Hotel, New York, NY, April 24, 2000.

US Environmental Protection Agency National Environmental Justice Advisory Committee, Enforcement Subcommittee, "Confined animal feeding operations," Atlanta, GA, May 25, 2000.

The challenge of environmental justice: Science, public health and advocacy, Minority Health Conference, School of Public Health, Chapel Hill, NC, February 18, 2000.

Environmental health effects of intensive livestock operations. Division of Occupational and Environmental Medicine departmental seminar, School of Medicine, Duke University, February 8, 2000.

United States Department of Agriculture Air Quality Task Force. "Health and intensive livestock operations," Research Triangle Park, NC, November 1, 1999.

Environmental injustice in North Carolina's hog industry. Regional Research Institute Colloquium, West Virginia University, Morganton, WV, October 8, 1999.

Community based research and environmental justice, African American Environmental Justice Action Network Conference, Arlington, VA, September 18, 1999.

Agriculture Committee, House of Representatives, North Carolina General Assembly, "Environmental Injustice in North Carolina's Hog Industry, " Raleigh, NC, April 27, 1999.

Intensive livestock operations, health, and quality of life among eastern North Carolina residents. Conference on Public Health Impacts of Intensive Livestock Operations, NC Department of Health and Human Services, Raleigh, NC, July 15, 1999.

Radiation and health, Hanford Downwinders Conference, Pendleton, WA, April, 1999.

Cancer and Three Mile Island, Three Mile Island Alert, Harrisburg, PA, March 26-27, 1999.

Environmental injustice in the North Carolina hog industry. Society of Toxicology Annual Meeting, New Orleans, LA, March 17, 1999.
Radiation and health, Livermore City Council, Lawrence Livermore National Laboratory, October 22-24, 1998.

Radiation and mortality among US Department of Energy workers: Relevance to radiation protection standards. NY Academy of Medicine, New York, September 26, 1998.

Health effects of Department of Energy Facilities. Physicians for Social Responsibility Annual Meeting, Arlington, VA, May 1, 1998.

Committee on Veterans Affairs, United States Senate, 105$^{th}$ Congress Second Session, "Ionizing Radiation, Veterans Health Care, and Related Issues," Washington, DC, April 21, 1998; published testimony: Serial HRG. 105-983, pages 14-16 and 111-113, U.S. Government Printing Office, Washington, DC.

Environmental justice in North Carolina, East Carolina University Brody School of Medicine, Greenville, NC, April 17, 1998.

Radiation epidemiology, Hanford Health Effects Subcommittee (CDC-ATSDR), Seattle, WA, 1997.

How communities affect epidemiology: A re-analysis of cancer incidence near Three Mile Island. Community Partnership Research Conference, Clark University, September 21, 1996.

How pure is the quantitative basis of epidemiology? An examination of four numerical concepts. London School of Hygiene and Tropical Medicine, July 1996.

Whose epidemiology, whose health? Department of Public Health, University of Liverpool, July 1996.

Department of Health and Human Services Advisory Committee on Energy-Related Epidemiologic Research, "Data collection and record access in epidemiological studies of workers at DOE facilities," Santa Fe, NM, April 18, 1996.

Occupational inequalities in mortality. Division of Occupational and Environmental Medicine, School of Medicine, Duke University, February 2, 1996.

Environmental epidemiology, Conference on Cancer and the Environment: Women's Action for Prevention, Shaw University, Raleigh, NC July 7, 1995.

An epidemiological triangle: Questions, answers and methods. Joint meeting of the Brazilian, Ibero-American and Latin American Congresses of Epidemiology, Salvador, Bahia, Brazil, April 24-28, 1995.

Radiation risks and mammography, Health and Today's Environment: A Symposium on Action for Cancer Prevention and Natural Health, Albuquerque, NM, October, 1994
Low-level radiation panel, Radiation Health Effects and Hanford: A Conference for Concerned Citizens and Health Care Providers, Spokane, WA, September, 1994

Health risks from ionizing radiation, Massachusetts Low-Level Radioactive Waste Management Board, Worcester, MA, November 3, 1993

Concepts in modern epidemiology: Population, risk, dose response and confounding. Workshop on Critical Theory in Epidemiology, Department of Preventive Medicine, Federal University of Bahia, Salvador, Brazil, June 14-18, 1993.

Recording of external radiation exposures at Oak Ridge National Laboratory: Implications for epidemiological studies. Workshop on the Epidemiologic Use of Nondetectable Values in Radiation Exposure Measurements. National Institute of Occupational Safety and Health, Cincinnati, OH, September 9 and 10, 1993.

Towards a post-Columbian science of disease causation. Indigenous Peoples Forum/Medical and Scientific Methods for Diagnosing Human and Environmental Effects from Nuclear Testing, Las Vegas, Nevada, October 2-4, 1992.

Subcommittee on Compensation, Pension and Insurance of the Committee on Veteran's Affairs, House of Representatives, 102nd Congress Second Session, "H.R. 3236 and H.R. 4458, Bills Affecting Veterans Exposed to Ionizing Radiation in Military Service," May 27, 1992. Published testimony: Serial No 102-42, pages 10-16 and 51-52, US Government Printing Office, Washington: 1992.

Recent findings on low-dose radiation and mortality at the Oak Ridge National Laboratory, U.S.A. Institute for Radiation Hygiene, Munich, Germany, March 5, 1992.

Recent findings on low-dose radiation and mortality at the Oak Ridge National Laboratory, U.S.A. German Cancer Institute, Heidelberg, Germany, March 4, 1992.

Recent findings on low-dose radiation and mortality at the Oak Ridge National Laboratory, U.S.A. Institute for Radiation Biology, University of Munster, Munster, Germany, March 3, 1992

Study of worker exposure at Oak Ridge National Laboratory. Low Level Radioactive Waste Forum Quarterly Meeting, New Orleans, LA, April 19, 1991.

Health effects of low level radiation, Chatham County, NC Low-Level Radioactive Waste Site Designation Review Committee, April, 1991

Health effects of low level radiation, Richmond County, NC Low-Level Radioactive Waste Site Designation Review Committee, April, 1991

Factors associated with the onset and magnitude of the decline of cardiovascular disease mortality in the United States. First International Searle Symposium on Prevention and Epidemiology, Ulm, Germany, July 5, 1990.

An epidemiological study of low dose occupational exposure to ionizing radiation. First International Searle Symposium on Prevention and Epidemiology, Ulm, Germany, July 5, 1990.

Social inequalities and health: The contradictory role of health professionals. 17th Annual Regional Conference on Maternal and Child Health, Family Planning, and Services for Children with Special Health Needs, Raleigh, N.C., May 2, 1990.

## TEACHING

### UNC Courses

2011-15 Lead instructor, Perspectives in Epidemiology and Public Health (EPID 890) (5 – 12 students per semester, fall and spring semesters)
A seminar for first-year MSPH students in the Department of Epidemiology.

2010 Lead instructor, Environmental Epidemiology (EPID 785) (14 students).

Introduction to topics and methods in environmental epidemiogogy.

2000- Lead instructor, Community-Driven Epidemiology and Environmental Justice (EPID 786) (7 – 15 students per semester)
Principles for conducting research within communities unduly burdened by environmental health threats. Topics include research ethics, community presentations, study design and implementation, and student research projects. EPID 278 was was selected as an innovative course by The Consortium for Environmental Education in Medicine in 2000, and was nominated by the Theta chapter of Delta Omega for the Delta Omega Award for Innovative Public Health Curriculum in 2001.

1997-99; 2007 Co-instructor, Occupational Epidemiology (EPID 276)

The course provides a background in the epidemiology of work-related illness and injury and the application of epidemiologic concepts and methods in protecting workers' health and safety.

1996- Lead instructor, History and Philosophy of Epidemiology (EPID 891) (12 – 28 students per semester)
This seminar exposes epidemiology doctoral students to issues and debates in the philosophy of science, the objects of knowledge in epidemiology, and the place of epidemiology in public health.

1994-97 Co-instructor, Advanced Methods in Epidemiology (EPID 268)
An in-depth treatment of key mehtodological topics in epidemiology, including concepts of cause, confounding, control selection, data quality, sampling variability, and effect modification.

1992-95 Instructor, Philosophy of Epidemiology (EPID 217)
A forum for evaluating the place of epidemiology in science, public health and society, focusing on the nature of objectivity and the social consturction of epidemiological knowledge.

1987-91 Instructor, co-instructor, Principles of Epidemiology (EPID 160)
An introductory course that considers the meaning, scope, and applications of epidemiology to public health practice and the uses of vital statistics data in the scientifi appraisal of community health.

1985-87 Co-instructor, Cardiovascular Disease Epidemiology (EPID 256)
Review of the main causes of cardiovascular disease morbidity and mortality, and their population determinants. Topics include epidemiologic methods, risk factors, strategies for prevention, and a student research project.

**Other Courses**

2011 Co-instructor, Cancer Epidemiology and Environmental Health Risk Assessment. University of Greifswald short course, Antalya, Turkey.

2007 Johns Hopkins University Fall Institute, Barcelona, Spain. Social Justice and the Environment (with Joan Benach).

1997 Co-instructor, Occupational and Environmental Epidemiology, Institute of Collective Health, Federal University of Bahia, Brazil. An introduction to epidemiology in occupational and environmental health.

1993 Lead instructor, Problems in Epidemiology: Methodology and Philosophy. Department of Preventive Medicine, Federal University of Bahia, Brazil.
An advanced seminar in philosophy of epidemiology conducted with faculty and students from UFBA.

1990 Co-instructor, Principles of Epidemiology, 4-week introductory graduate-level course. University of Ulm, Germany. An introductory course that considers the meaning, scope, and applications of epidemiology to public health practice and the uses of vital statistics data in the scientific appraisal of community health.

## CONTRACTS & GRANTS

### Submitted

Health and Air Pollution from Confined Animal Feeding Operations (principal investigator). National Institue of Environmental Health Sciences, R01, proposed 9/1/2014-8/31/2019.

Aromatic Amines and Bladder Cancer among Workers Exposed to Epoxy (co-investigator). National Institute for Occupational Safety and Health, R01.

### Active

The impact of intensive livestock production on the disease ecology of antibiotic resistant staphylococcus (co-investigator). National Science Foundation, 2013-2016.

Air emissions from industrial animal operations and respiratory health of adolescents (principal investigator), Johns Hopkins University, 2009-2015.

### Completed

2014 North Carolina Environmental Justice 2014 Summit Proposal (principal investigator), National Institue of Environmental Health Sciences, R13.

2013 Pathways for human uptake of emerging chemicals of concern in land-applied sewage sludge. Center for Environmental Health and Sustainability small grant (principal investigator), NIEHS.

2013 North Carolina Environmental Justice 2013 Summit Proposal (principal investigator), National Institue of Environmental Health Sciences, R13.

2009 Long-term Effects of Occupational Radiation Exposures (co-investigator), 2009-13.

2007 Community Health Effects of Sewage Sludge (principal investigator). National Institute of Environmental Health Sciences, 2007-2013.

2006 Epidemiologic Surveillance and Investigation of Symptoms of Illness Reported By Neighbors of Biosolids Land Application Sites (principal investigator), Water Environment Research Foundation, 7/1/2007-8/31/2008.

2003 Agricultural Dust and Childhood Asthma Symptoms (principal investigator, doctoral research of Maria Mirabelli), National Heart Lung and Blood Institute R01 HL073113, 04/01/03 – 03/31/05.

2002 Improving Environmental Health Research Through Dialogue (co-investigator). National Institute of Environmental Health Sciences, 9/30/02 - 8/31/07.

2002 Susceptibility in Occupational Radiation Risks (co-investigator). National Institute for Occupational Safety and Health, 9/30/02-9/29/05.

2002 Time-Factors in Exposure Effects Among Uranium Workers. (co-investigator). National Institute for Occupational Safety and Health, 5/01/02 - 4/30/05.

2002 Community-Driven Research on Environmental Justice and Landfills in North Carolina (principal investigator). Jesse Ball duPont Fund, 01/01/02 – 12/31/05.

2001 Community Health Effects of Industrial Hog Operations. (principal investigator). National Institute of Environmental Health Sciences, 09/01/01 - 08/30/08.

2000 Work and Health Disparities among Rural Women: Epidemiology Support (principal investigator). Duke University -- National Institute of Environmental Health Sciences, 09/30/00 - 09/29/05.

2000 Short Courses for Environmental Health Research Ethics: North Carolina Component (principal investigator). Syracuse University -- National Institute of Allergy and Infectious Disease, 09/30/00 - 08/31/06.

2000 Community Health and Environmental Reawakening (principal investigator). National Institute of Environmental Health Sciences, 09/01/00 - 04/30/09.

2000 Minority Graduate Research Assistant Supplement to Community Health and Environmental Reawakening (principal investigator). National Institute of Environmental Health Sciences, 09/01/00 - 08/30/01.

1999 Environmental and Public Health Impacts of Intensive Livestock Operations in the Wake of Flooding from Hurricane Floyd (principal investigator). Center for a Livable Future, Johns Hopkins School of Public Health, 01/01/00 - 12/30/00.

1998 Rural Health Study (principal investigator). North Carolina Department of Health and Human Services, 7/1/98 – 6/30/99.

1998 Older Women, Dietary Intake and Dependence on the Local Food Environment (principal investigator, doctoral research of Kimberly Morland, 07/01/98 – 06/30/99.

1997 Enabling Community-Based Environmental Research and Education (Principal Investigator). Chancellors Office, University of North Carolina at Chapel Hill, 12/01/97 - 6/30/98.

1997 Environmental Justice and Community-Based Prevention/Intervention Research Conference Grant, supplement to Southeast Halifax Environmental Reawakening (principal investigator). National Institute of Environmental Health Sciences, 09/01/97 - 08/31/99.

1996 Bahia-US Environmental Epidemiology Training and Research (co-investigator). Fogerty International Center, National Institutes of Health, 9/30/96 - 09/29/01.

1996 Ionizing Radiation and Mortality Among Hanford Workers (principal investigator). National Institute for Occupational Safety and Health, 09/30/96 - 09/29/01.

1996 Southeast Halifax Environmental Reawakening (principal investigator). National Institute of Environmental Health Sciences, 09/01/96 - 08/30/00.

1996 Critical Review of the United States Department of Energy Efforts to Investigate the Human Health Effects of Plutonium (principal investigator). Berger-Montague, 07/18/96 – 07/17/97.

1995 Time Related Factors in Radiation-Cancer Dose Response (principal investigator, Doctoral research of David Richardson). National Institute for Occupational Safety and Health, 07/01/95 - 06/30/97.

1994 Epidemiological Studies of the Accident at Three Mile Island (principal investigator). Center for Environmental Studies, John Snow Institute, 03/01/94 - 12/31/95.

1993 Study of Multiple Myeloma Among Workers Exposed to Ionizing Radiation and Other Physical and Chemical Agents (principal investigator). National Institute for Occupational Safety and Health, 10/01/93 - 02/29/96.

1992 Geographical Differentials in Stroke Mortality Levels and Trends in the U.S. (principal investigator). Centers for Disease Control, 08/28/92 - 03/30/93.

1992 The Potential Impact of Ill-Defined Mortality on the Decline of Ischemic Heart Disease in the U.S. (principal investigator, Doctoral research of Donna Armstrong). American Heart Association, North Carolina Affiliate, 07/01/92 - 06/30/93.

1990 Minority Graduate Research Assistant Supplement to Community Structure and Cardiovascular Mortality Trends (principal investigator). National Heart, Lung and Blood Institute, 07/01/90 through 05/31/92.

1989 Community Structure and Cardiovascular Mortality Trends (principal investigator). National Heart, Lung and Blood Institute, 06/01/89 - 05/31/93.

1987 Health and Mortality of Department of Energy Workers (co-investigator). U.S. Department of Energy, 10/01/87 - 03/31/94.

## SERVICE

### Department

Masters Examination Committee, Ad Hoc Core Course Review Committee, Masters Program Committee, Departmental Seminar Committee, Ad-hoc Task Group on Integration of the Core Methods Courses, Faculty Task Group on Course Evaluations, Curriculum Committee, Doctoral Qualifying Examination, Graduate Studies Committee, Awards Committee, MSPH Program Advisor

### School

Greenburg Alumni Endowment Awards Committee, 2005
UNC Housekeeper Health Study Co-investigator, 1997-1999
Committee on Learning Environments and Research Networking for the 21st Century, 1995-1996
Institutional Review Board, 1994-1997
School of Public Health Awards Committee

### University

Center for Health Promotion and Disease Prevention Population and Policy Working Group, 1998
University Faculty Council, 1993-1996
Buildings and Grounds Committee, 2009-2012

### State

Member, Toluene Diisocyanate Advisory Panel, NC Division of Occupational and Environmental Epidemiology, 2007-2009.
Vice-President, NC Conference of the American Association of University Professors, 2007-2009.
North Carolina Central University, Advisory Board, Environmental Risk and Impact in Communities of Color and Economically Disadvantaged Communities, 2001-2002.
North Carolina Environmental Justice Network, member, annual NC Environmnetal Justice Summit Planning Committee, 1998 - present.
Center for Community Action, Lumberton, NC. Reviewer, health effects of tire pyrolysis facility, 1996.
Clean Water Fund of NC, Ashville, NC. Review of cancer studies in Paw Creek conducted by the NC Department of Health and Human Services, 1996.
Land Loss Fund, Tillery, NC, consultation on land loss and public health, National Black Land Loss Summit planning committee member, 1996.
UNC Alumni Heart Study (Duke University), research design consultation, 1985-88.

**National**

Institute of Medicine, Exploring the True Costs of Food: A Workshop, 2012
Agency for Toxic Substances and Disease Registry, peer reviewer, 2002.
Concerned Citizens for Nuclear Safety, Santa Fe, NM, 2000-2002.
California Environmental Protection Agency, member and Co-Chair, Santa Susanna Field Laboratory Advisory Panel, 2000-2002.
East Hampton Town Hodgkin's Cancer Task Force, East Hampton, NY. June 4-5, 2000.
US General Accounting Office, Denver, CO. Epidemiological evidence relevant to radiation protection, 2000.
West Virginia University, Morganton, WV. Social Environment and Rural Community Health Project, October 7-8, 1999.
National Academy of Sciences, Washington, DC. Reviewer, Review of the Hanford Thyroid Disease Study Draft Final Report, 1999.
Rural Coalition, Washington, DC. Presentation and consultation on community based evironmental health research, National Advisory Board, April 6, 1998.
Pan American Health Organization, Washington, DC. Review of literature on social inequalities in health (with David Richardson), 1998.
Ministry of Health and Environment, Schleswig-Holstein, Kiel, Germany. Review of literature on radiation health effects (with David Richardson and Alice Stewart), 1997-1998.
Clark University, Worcester, MA. Member of planning committee, Community Research Partnership Conference, 1996.
Yakama Indian Nation Environmental Restoration and Waste Management Program, Toppenish, WA. Consultation on radiation epidemiology, 1995.
Centers for Disease Control, Atlanta, GA. Reviewer of educational materials on health effects from the Hanford Plutonium prodcution facility, 1995.
American Public Health Association, Washington, DC. Member, Task Force on Social Welfare Policy, 1992-1993; co-author of Social Welfare Policy Statement.

Three Mile Island Public Health Fund Scientific Advisory Board, Philadelphia, PA. Consultation on radiation epidemiology, October, 1992.

Ministry of Health and Environment, Schleswig-Holstein, Kiel, Germany. Consultation with the Minsister of Health regarding radiation protection policy. March, 1992.

Northwest National Life Insurance Company State Health Rankings, Delphi Panel Member, 1992.

**International**

Scientific and Ethics Committee for the Clinical Study of the F1 Offspring of A-bomb Survivors

## LEGAL RESEARCH AND TESTIMONY

United States District Court for the Southern District of West Virginia, OVEC et al. vs. FOLA Coal Company, LLC, 2015.

United States Environmental Protection Agency, Complaint Under Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, 40 C.F.R. Part 7, 2014.

United States District Court for the Easter District of North Carolina, Multiple Plaintiffs vs. Murphy Brown, LLC, 2014.

United States District Court for the Western District of Pennsylvania, Alynda Talmadge, et al. vs. Babcock and Wilcox Power Generation Group, Inc., et al., 2014.

Wake County Superior Court, Waste Industries USA, Inc. and Black Bear Disposal, LLC vs. State of North Carolina and North Carolina Department of Environment & Natural Resources. 2010.

State of North Carolina Wake County Office of Administrative Hearings. Jerry Franks, Petitioner, vs. North Carolina Department of Environment & Natural Resources and Wake County Board of Commissioners, Respondents.

United States District Court for the District of Colorado, Merilyn Cook, et al. v. Rockwell International Company and the Dow Chemical Company, Civil Action No. 90cv00181JLK.

United States District Court for the Middle District of Pennsylvania. TMI Litigation Cases Consolidated II, Civil Action No. 1:CV-88-1452.

United States District Court for the Eastern District of Tennessee Northern Division at Knoxville. Euchee Marina & Campground, et al., Plaintiffs vs. Martin Marietta Energy Systems, Incorporated, et al., Civil Action No. 3-91-0510.

United States District Court for the Southern District of California. Glen and Doreth James, Plaintiffs, vs. Southern California Edison Company, et al., Case No. 94-1085 NJ (RBB).

District Court of Harris County, TX, 125th Judicial District. Terry Joe Groom, Plaintiff, vs. Schlumberger Technology Corporation et al., Case No. 94-42682.

United States District Court for the District of Colorado. Merilyn Cook, et al., Plaintiffs, vs. Rockwell International Corporation and The Dow Chemical Company, Civil Action No. 90-K-181.

Carolyn Mull, Personal Representative of the Estate of Roy Mull, Employee/Plaintiff vs. Duke Energy Corporation, Employer/Defendant, North Carolina Industrial Commission File No. 717904.

## JOURNAL REVIEW

Accountability in Research: Policies and Quality Assurance
American Journal of Epidemiology
American Journal of Industrial Medicine
American Journal of Public Health
Annals of Epidemiology
CA - A Cancer Journal for Clinicians
Environmental Health
Environmental Health Perspectives
Environmental Research
Environmental Science: Processes and Impacts
Epidemiology
Epidemiology Research International
Health Education and Behavior
Journal of Epidemiology and Community Health
Journal of Exposure Science And Environmental Epidemiology
Journal of Gerontology
Medicine and Global Survival
New Solutions: A Journal of Environmental and Occupational Health Policy
Occupational and Environmental Medicine
Progress in Community Health Partnerships: Research, Education, and Action
Radiation Research
Science of the Total Environment
Social Movement Studies
Social Science and Medicine
New England Journal of Medicine
New Solutions

## GRANT REVIEW

NIEHS special emphasis panel for Conference Grants (R13 Applications), April, 2014

NIEHS special emphasis panel, Environmental Justice: Partnerships for Communication, April, 2005.

NIEHS special emphasis panel, Environmental Health Sciences Center Grants, June, 2002.

NIEHS special emphasis panel, Community Based Prevention and Intervention Research, March 2000.

NIEHS special emphasis panel, Environmental Justice: Partnerships for Communication, February 1999.

NIEHS special emphasis panel, Community Based Prevention and Intervention Research, July 1996.

Alberta Cancer Board, 1992.

## O'Lone, Mary

**From:** O'Lone, Mary
**Sent:** Tuesday, September 29, 2015 4:44 PM
**To:** Farrell, Ericka
**Cc:** Rhodes, Julia; Covington, Jeryl
**Subject:** FW: REACH 11R-14-R4
**Attachments:** 11R-14-R4 ADR complainant (09252015 (2)).docx; 11R-14-R4 ADR complainant (08202015).docx; 11R-14-R4 ADR Vaart (08202015).docx; 11R-14-R4 ADR complainant (09252015 (2)) mmo.docx

Ericka-

The second draft letter to Earthjustice you sent had a sentence that just ended midstream, so I worked with the first draft version you sent b/c it seemed like a complete letter. This is the only letter I provided edits on.

**Attorney Client / Ex. 5**

Thanks, Mary

Mary O'Lone
Civil Rights and Finance Law Office
Office of General Counsel
US EPA
1200 Pennsylvania Avenue, NW
Washington, DC 20460
(202) 564-4992

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**From:** Farrell, Ericka
**Sent:** Tuesday, September 29, 2015 8:12 AM
**To:** O'Lone, Mary
**Subject:** RE: REACH 11R-14-R4

Good Morning Mary,

OCR was leaving that up to you regarding which letter to send. Will stated the first letter that was drafted is fine. I however, put in the information that you thought should be in the revised letter. So I have two versions for the complainant. The one for the recipient I did not change.

Ericka

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**From:** O'Lone, Mary
**Sent:** Monday, September 28, 2015 5:16 PM
**To:** Farrell, Ericka
**Subject:** RE: REACH 11R-14-R4

Sorry Ericka-
Is there just one letter I am supposed to look at?
I just need the version you want to send.

Mary O'Lone
Civil Rights and Finance Law Office
Office of General Counsel
US EPA
1200 Pennsylvania Avenue, NW
Washington, DC 20460
(202) 564-4992

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**From:** Farrell, Ericka
**Sent:** Friday, September 25, 2015 12:35 PM
**To:** O'Lone, Mary
**Subject:** REACH 11R-14-R4

Good Afternoon Mary,

Here are revised drafts that I hope meet your questions/concerns. I have attached two versions and the original version which Will stated was sufficient.

Ericka

Ericka Farrell
Office of Civil Rights
External Complaints & Resolution
2025640717

EPA

Moderator: Jonathan Stein
May 12, 2016
11:05 a .m. ET

Operator: This is Conference #160552132
Conference record has joined the conference.
Ericka Farrell: Hello?
Jill Johnston: Hello. This is Jill Johnston.
Mary O'Lone: Hi Dr. Johnston. Is Marianne on the line yet?
Marianne Engelman Lado: OK, you know what? We were mute. My apologies. So this is Marianne Engelman Lado from Earthjustice and I'm here with three colleagues and I'll let them introduce themselves.
Alexis Andiman: This is Alexis Andiman, also Earthjustice.
Brent Ducharme: Brent Ducharme from the UNC Center for Civil Rights.
Elizabeth Haddix: And Elizabeth Haddix, also from the Center for Civil Rights.
Marianne Engelman Lado: Hi there. Who's there at EPA?
Ericka Farrell: OK. We got Ericka Farrell from OCR, Title VI Office.
Jeryl Covington: Jeryl Covington from OCR Title, VI Office.
Mary O'Lone: This is Mary O'Lone. I'm from the Office of General Counsel.
Johanna Johnson: Hi. This is Johanna Johnson also from the Officer of General Counsel.
Marianne Engelman Lado: Hi there. Thank you.
Ericka Farrell: OK. Good afternoon. Again, this is Ericka Farrell from the Office of Civil Rights, Environmental Protection Agency in Washington, D.C. and thank you for taking the time to talk with us. And please be aware that this interview of Dr. Jill Johnston is being recorded. And, are there any objections to recording this interview?
Jill Johnston: No.
Marianne Engelman Lado: Dr. Johnston, do you have any objections?
Jill Johnston: No I guess.
Ericka Farrell: OK. Thank you. And, as you know, your August 2014 study was submitted to OCR to rely upon in this investigation and so whether North Carolina Department of Environmental Quality Regulations of swine feeding operations discriminate against African-Americans, Latinos, and Native Americans on the basis of race and national origin in neighboring counties and violation of Title VI and EPA's implementing regulations. And today we plan to ask some – ask you some fundamental question. I'm sorry, foundational questions, regarding the study in order for the OCR to determine whether we can rely on this study for our investigation. And in doing so, we are trying to understand what issues and arguments may be raised in opposition to your study. And we may need to ask you further questions at a later date.

And as we get started, we're going to start right now, Dr. Johnston with just some basic background questions. And can you please state for the record your name.
Marianne Engelman Lado: I'm sorry. Ericka – Ericka, if I can just interrupt you for a second. I just want to make sure, there were two studies that Dr. Wing and Dr. Johnston did conducted and then we submitted. One was the 2014 which you mentioned and the other was the revised version that's dated that it was exhibit 12 to a submission earlier this year. And it was dated October 19th, 2015 and it's based on that current set of hog facilities that are under the general permit. I just want to make sure both are in front of you.
Mary O'Lone: Well Marianne, the other one is not. The second only update. That's going to be one of our question. I'm sorry. This is Mary O'Lone. That was going to be one of our questions. Jeryl is now looking to see if we have it in our record.
Jeryl Covington: Right. As if Exhibit 12, that's the declaration by Personal Privacy / Ex. 5
Mary O'Lone: No. She sent on something –
Marianne Engelman Lado: So Jeryl, is not Exhibit 12 to the complaint. It's attachment 12 to a subsequent submission that we made in 2016 that contains Steve Wing's declaration and it contains the revision of the study.
Mary O'Lone: What's the date of that because they're shaking – this is Mary again, their shaking their heads like OCR doesn't have it.
Marianne Engelman Lado: April 12th, you did received it. I'm certain of that. April 12, 2016. And it had – and this is attachment 12. And it's important, you know, we'll get into the methodologies and all that. But you know, we wanted to make sure that there was a study of the actual data under the new permit. And this revised study is based on that, the data under the new permit.
Mary O'Lone: OK.
Marianne Engelman Lado: And we should go ahead even if you can't find it, you can ask questions based on the first study and we can resume at another time. That will still be helpful I'm sure. But it's important that you have that second study.
Mary O'Lone: Are you, Marianne – this is Mary again, are you at your desk? I mean can your e-mail it to Jeryl?
Marianne Engelman Lado: Yes.
Mary O'Lone: E-mail it to all of us so that at least we know we have it. They'll go back and look for it. But I just want to make sure that we do get it today. But I also agree with you. Because I think unless the methodology changed from the report submitted with the complaint to today, the questions would be the same. It's just a matter of the conclusions or results, right? That's what would have changed potentially.
Marianne Engelman Lado: That's right. I mean, I'll let Dr. Johnston speak and she'll answer specific questions about that. But the basic methodology is the same – there was – there may have been some tweaks that when you focused on it, she can answer questions about. So Alexis is forwarding it and – who's – so who's going to – if they look for an e-mail who would it be from?
Alexis Andiman: Is there just one e-mail I can send it to you and I'll just forward it to you right now.
Marianne Engelman Lado: Who should we send that for?
Mary O'Lone: Covington.jeryl.
Marianne Engelman Lado: OK. Got that.
Mary O'Lone: @epa.gov.

Jeryl Covington: We do not – yes, we do not received that. I don't have a copy of that.
Mary O'Lone: Okay. So back to the beginning.
Ericka Farrell: Yes. For the record, Dr. Johnston, can you please provide your full name?
Jill Johnston: Jill Elizabeth Johnston.
Ericka Farrell: And please provider your professional contact information, specifically your office address and office telephone number and office e-mail.
Jill Johnston: Yes. It's 2001 North Soto Street, Los Angeles, California 90089. My office phone number is 323-442-1099 and my e-mail is jillj@usc.edu.
Ericka Farrell: Thank you. And as we begin, can you also state what your current professional position is?
Jill Johnston: An Assistant Professor of Preventive Medicine in the Division of Environmental Health at the University of Southern California.
Ericka Farrell: OK. And as we begin, also, can you give us what your professional background is in relation to the studies that we're going to be talking about today.
Jill Johnston: Yes. I have a PhD in Environmental Science and Engineering with the minor in public policy from the University of North Carolina at Chapel Hill and also completed a Post-Doctoral Fellowship in Environmental Epidemiology also at UNC.
Ericka Farrell: OK. And now, I'm going to turn this over to Mary O'Lone.
Mary O'Lone: So this is Mary O'Lone. Dr. Johnston, Marianne's probably explained to you one of the reasons that we wanted to speak with you. And after we go through the questions that we have, you can see why it was very good idea for us to speak to you first. Because what we wanted to do when Marianne explained Personal Privacy / Ex. 5 and that you know, if we had a chance to speak with him in the future, we wanted to try to limit the questions that you know, we would be asking him. So, we really appreciate you taking yourself available to answer these questions with us. Because I think, there are a lot of them and a lot it comes from the fact that we don't have a particular background on this. So, we're going to ask you probably some very basic questions from your perspective.
Jill Johnston: OK.
Mary O'Lone: But the first one is your role in the – we're going to talk first about the 2014 study. And your role in that study.
Jill Johnston: Yes, so I collected the data and conducted the analysis in consultation with Dr. Wing and created that the table and the figures in this report and help with drafting the text. But Dr. Wing took the lead on writing the text for this.
Mary O'Lone: OK. Was this study peer reviewed or did it go through any kind of even informal internal sort of peer review?
Jill Johnston: There was discussion with other faculty within our department at University of North Carolina but it was not submitted or considered under scientific peer review process for a journal.
Mary O'Lone: OK. And we might as well ask the update that was done. Is it similar?
Jill Johnston: Yes, (inaudible) it was probably not submitted or have been under a scientific peer review.
Mary O'Lone: OK. Do you – and Marianne I don't know if this is – this is may be a question for you. I don't know if it's for you or Dr. Johnston, but was the – was the 2014 study submitted to North Carolina DEQ?
Jill Johnston: No.
Mary O'Lone: OK. Or do you know if they're aware of it?

Jill Johnston: Not to my knowledge.
Mary O'Lone: OK. All right. Now we're going to get into sort of a knots and bolts of the questions that we had about the study itself. So, Dr. Johnston, do you know – can you explain why three miles was chosen as the distance?
Jill Johnston: Yes, so we based that on a few (inaudible) peer reviewed scientific studies. One is by Mirabelli from 2006 that specifically looked at asthma prevalent in middle school students in North Carolina and found that middle schools within a three mile radius of an industrial hog operation had higher prevalence of asthma, and other asthma related symptoms, compared to students who went to school further away. Also some dispersion modeling of hydrogen sulfide conducted of at a large hog CAFO in Iowa show that hydrogen sulfide can travel up to 6 kilometers which is a little over three miles from the facility itself and impact air quality in that radius. And there was also sort of two other studies that looked at, the relationship between hydrogen sulfide protections and hog CAFOs one from North Carolina and one from Iowa. The one from North Carolina being by Guidry in 2016 and then by Pavilonis in 2013 that used 5 kilometers as their distance.
Mary O'Lone: OK. Thanks. Did you by any chance look at other distances or analyze other distances that weren't discussed in the 2014 report?
Jill Johnston: So we did not. We considered different criteria for inclusion of census blocks, you know, whether any part was within three miles or whether they're centroid. But we didn't have a capacity to compare our three mile results to two miles or one mile or some other criteria.
Mary O'Lone: OK. How was –the basic question, how was the block centroid determined? Was it geographic, location or?
Jill Johnston: Yes. So (inaudible) our GIS software with you know, the census block data from the U.S. and to 2010. And then, yes, the program assigned the centroid.
Mary O'Lone: So it assigned that based on the geographic center of the block not something to do with the population.
Jill Johnston: It had nothing to do with population, yes. It had to do with what the spatial definition of where the centroid would be based on the shape of the block.
Mary O'Lone: OK. For the study area, 19 counties were excluded that didn't have an IHO and didn't border one. Why was it important to exclude those 19?
Jill Johnston: We thought it appropriate to consider population that were potentially at risk for being near an industrial hog operation. And so, just the geography and mountainous nature of Western North Carolina, you know, as well as highly urbanized areas. Or just not locations where CAFOs would be sited. So we didn't consider those population at risk and that did not include them in the study area for this analysis.
Jeryl Covington: Yes. This is Jeryl Covington. I do have one question on that one. You all were also excluding the counties that were adjacent to and had no – please give – can you explain the basis for that exclusion as well to the 19 counties in the Western North Carolina area.
Jill Johnston: So we excluded counties where they had to meet two criteria. One is they had no CAFOs in their borders and no adjacent county for them had any CAFO. And it's largely because these areas are highly mountainous and don't have the facilities or the land mass that you need for the liquid waste distribution system for a CAFO to be permitted there.
Mary O'Lone: Ok?
Jeryl Covington: OK.

Mary O'Lone: This is Mary again. What is the – can you explain the adjustment for rurality and is that the same thing as adjusting for population density. And then why was that appropriate?
Jill Johnston: Yes. So – yes. The – so the content of rurality we measured it by population density for each census block. And we find this – and so we present both the unadjusted and the adjusted values in the report. But find that this is important because the land availability and also typically the price of land is highly influence by the population density in the amount of land that is available. And also different patterns of which racial or ethnic group within which areas can be – can influence population density as well. So that's why we – we chose that content of both the marker of kind of the economics and the land availability to adjust for in the model.
Jeryl Covington: This is Jeryl again, could you – could you clarify the land availability. I wasn't quite clear on that explanation.
Jill Johnston: OK. Yes, so, I mean. As I mentioned before, not only do you need the barns to house the animals but then also you know, fields around it where the waste is sprayed. So an area with the high population density, you're not going to have – it's not necessarily going to be appropriate to have the space availability to put a CAFO in those areas or to put as many. And – it's basically, the land available for agriculture can basically correlated with the population density of that area.
Mary O'Lone: But that was – OK. This is Mary again. Because I – you can't see me but my brain is cranking very slowly. But, so this is not because you were excluding these areas because you've already excluded the 19 counties that have nothing. Now you're doing an adjustment to say, to basically say that OK, in the – to find that the… the more sparsely populated – maybe we'll get into when we get back into the table in explaining those. But I'm trying to understand the fundamental points of why you did it. And it is to say that these things tend to go in really rural areas. And you know, as we look at areas they get more and more rural, we also see, you know, where they are, the amounts of hogs there are and a change in the demographics. That's why you're doing the rurality piece to it?
Jill Johnston: Yes. And it's sort of a concept of, I guess they're familiar with confounding and other epidemiological models. So we felt that population density is a very important factor that influences the siting of hog CAFOs. And so, that's why we presented sort of adjusted models to acknowledge the fact that population density as sort of a proxy for both the cost of land and the sort of amount of land that would be available for either agricultural activity was important to consider when we're looking at the association between race and permitting of hog CAFOs.
Marianne Engelman Lado: This is Marianne. Can I jump in for a sec. On page 4 of the 2014 reports, Dr. Johnston, you have –there's a sentence there that says, by adjusting for populations density or rurality, we compare racial vulnerability that IHOs for racial groups within each level of rurality –
Jill Johnston: Right.
Marianne Engelman Lado: I think that's what you're getting at. Can you explain that a little bit more that is – so it's not taking away the salience of race but testing for it by looking within each level of rura…, I can't even say the word, rurality. Is there still salience of race towards this outcome? Is that right?
Jill Johnston: That is correct and we try to provide an example here that perhaps is a little bit more intuitive. But for example, like when you're looking at mortality rates and you want to compare across two different populations. It's important to account for age because of risk of mortality changes with different age groups. And so if the age structure of the two populations

aren't equal, you want to address for those factors or account for those factors so that you can look within each age group. So essentially, we're trying to account for the same thing here that acknowledges that perhaps your risk for a CAFO being permitted nearby you is different depending on the population density of the area where you live. And so by including that adjustment, we can account for those differences across different areas in North Carolina.
Mary O'Lone: OK. Is everybody good on that right now? OK. OK. Can you explain the study state live weight calculation? So we're on page 4 again of the 2014 study. And how did you determine whether the study state live weight of an IHO should be included and I – this is – it's not about the calculation of the city state live weight but more – how you captured a particular IHO. And I sort to have two visual images in my mind. And one has – you take the centroid of a block and you draw a circle three miles out, right?
Jill Johnston: OK.
Mary O'Lone: This is what I'm thinking happened. And the latitude and longitude of any IHO that fell within that three mile circle is what you counted. Is that right?
Jill Johnston: That is correct. And it was some, but yes. We started the centroid of each block. And did exactly what you describe.
Mary O'Lone: Because, well we were trying to figure out whether there was anything – whether it was like if you had, instead you were pulling, if there were a block that straddled the three mile circle, you know, you would pull an IHO that might be sitting in that block. Do you know what I mean? But that's not what you did. You just – it was if the latitude and longitude of that CAFO fit in the circle. Then it was added to the total weight.
Jill Johnston: Yes. So in essence, each CAFO was not counted one time. It could be counted multiple times depending on how many blocks it was within three miles from.
Marianne Engelman Lado: In other words, this is Marianne Engelman Lado again, Dr. Johnston, if there was a CAFO that straddled that three mile radius or was in one radius and then another radius, how would you handle it?
Jill Johnston: Yes. So our unit of analysis is the census block. And so for each census block sort of independent of all the other ones, we would draw the three mile radius and count up every CAFO that fell within the three miles. And then we would go to the next, you know, the adjacent block to it. Draw a circle and count up every CAFO within three miles of that block. And so, so the sum of the steady state live weight, could be counted, you know, if not, we didn't assign each CAFO only to one block. We assigned each block to the nearby CAFOs. Does that help explain it?
Marianne Engelman Lado: I think so.
Mary O'Lone: Well, so then the next, I guess my next question is when you look at the people. So the latitude and longitude has to be within third, three mile circle. And then when you count the people, how are you doing that?
Jill Johnston: So the people aren't counted more than once. We, we include the population of each census block. So, all the – there's a hundred people living in the census block, they're all assigned the same study state live weight based on what the three mile radius.
Mary O'Lone: OK. OK.
Jill Johnston: So people are not counted more than once in the model.
Mary O'Lone: OK. I get it. Anybody else have any question about study state live weight? All right. OK, the next question was about you know, asking you about the update. Did the update happen but we know that it did. So, we will skip that one and come back to it at a later date probably.

Jill Johnston: OK.
Mary O'Lone: So on page 4, you describe how race and ethnicity was categorized. But then when we looked at the complaint, we went – and we looked at page – where is that? 106. 106. OK, on page – I don't know what – 35 of the complaint. It also talks about the characterization in particular of African-Americans. And the description seemed, seemed inconsistent to us. And it had to do with people who could identify themselves as black and Hispanic. And so, we were wondering if, if these two – if the statement about it on page 4 of the 2014 report and footnote 106 on page 35 of the complaint, whether they were inconsistent or weren't inconsistent or you know, like how we should be interpreting this.
Jill Johnston: I mean, so I can describe the definition we used in the report and then maybe Marianne can talk about the footnote. But we used for of one the census categories. And so, our definition of block was anyone who identified it – identified themselves as African-Americans are black with or without any other race or ethnicity. So if they identified as black and Hispanic, it would be categorized in this black group. So that's how we did it for the purposes of this –
Mary O'Lone: Ok.
Marianne Engelman Lado: I'm sorry Dr. Johnston in – on page four it says black is people who identify themselves as African American or Black with or without any other race. Is that right? I thought just heard only without – with.
Jill Johnston: Yes.
Marianne Engelman Lado: I'm sorry without.
Jill Johnston: No, I'm sorry if I said that I misstated. No, I meant – yes, how it's written here is correct. So it's –
Marianne Engelman Lado: And then footnote 106 says the term African American herein corresponds black as used in the report it – the black racial category referred to those who identified as African American – that's probably a typo. It should be with or without.
Mary O'Lone: OK, all right.
Johanna Johnson: Hi this is Johanna Johnson. I just one quick follow up question. And that's with regards to individuals who identify themselves as Black Hispanic. You indicated they will be categorized in the black category. But would they also appear in the Hispanic category as well?
Jill Johnston: Yes, So I would note one of the (inaudible) these terms but the definitions of Black, Hispanic and America Indian. We do not use mutually exclusive terms or mutually exclusive categories. So people when we do the race specific analyses they could be counted with more than one race based on what they identified on their census forms.
Mary O'Lone: OK, any other –
Jill Johnston: But the category of non-Hispanic white and people of color. Those two are mutually exclusive. So there's no one that overlap, you know, which is what we use for our primary analysis.
Mary O'Lone: Right. Anything else?
Johanna Johnson: No.
Mary O'Lone: OK. Now what we'd like to do and Marianne maybe you can help in the updates that was sent. You know is it just the numbers that have changed? Well let me explain what I'm going to do here. What we wanted to do was walk through in a study. Each of the tables – each of the figures and tables to make sure we understand what they say and then

we wanted to look at them – look at how they're characterized in the complaint because one of the things that we have to do as we discussed it internally is be able to communicate in layman's terms how these – what these findings are. So we want to make sure that we understand it and we can see that, you know, the complaint takes, you know, writes up something. And so we wanted to see – we wanted to make sure that, you know, what was in the study or I mean what was within the complaint could, you know, use that as our layman's discussions. So we wanted to cross walk these things but also go through them and make sure that we actually understand, you know, what the study itself is saying. OK?
Marianne Engelman Lado: Yes, let me give some context and I don't know if this will be helpful or not but let's try. First of all Elizabeth reminded me and we will double check. When we filled the complaint we probably sent a copy to then DENR now DEQ.
Unknown Female Speaker: I think that's right.
Marianne Engelman Lado: There were some confidential documents in there. So we didn't send the whole thing. And we'll have to go back and check our records and let you know what we sent and what we didn't. I don't see any reason – I mean this was not a confidential document. But I just don't remember. So and I'm not sitting in front of the, you know, my computer where I can pull up exactly what was sent to DEQ. So, so we'll do that and we'll get back to you on that. In terms of the difference let me tell you our thinking and methodology as complainants. And then Dr. Johnston can say a little bit about what might have been different, if you remember Dr. Johnston. So we obviously wanted to get, even though the 180 day requirement is waivable we wanted to get a complete set of allegations into OCR within 180 days. So we wanted to do it–submit a disproportionality analysis that was rigorous within that 180 day timeline. The challenge is at the 180 day timeline, the data – I think it wasn't even up on the Website for DEQ then DENR. But if it was, not with sufficient notice to be able to ask Dr. Wing and Dr. Johnston to do an analysis. So talking to – knowing that there wasn't going to be that much difference in the location of these facilities for technical reasons which you may be aware of that any new facility in the State of North Carolina have to use new technologies. And it's only pre-existing facilities that haven't expanded that are under the state the general permit. So while some facilities may drop out of the list there are not going to be any new facilities on the list. And there's kind of disincentive to drop out. So we knew there wouldn't be that much change. So we did ask Dr. Wing and Dr. Johnston if it made sense to do the disparities analysis first on the list that existed at the time right before we filed the complaint which is what they did with the – and then and they could refine their methodology by doing tha,t building on the work that they had previously done on disproportionality.
And then once – once we had the list and I should say and Dr. Johnston you can talk more about this, there was a lot of work that went into that. There was a lot of clean up of the data. The – the geographic locations often weren't right. There was just a lot of work that went into working with that list. And then they were able to provide the 2014 disproportionality analysis. But with the full intent that once we had the – the list of facilities that had been approved for operation under the challenge firm and are under the new permit they would then conduct the same analysis.
But I say the same kind of in quotes because if there were any – any lessons learned or any tweaks that the new data provided that they would – they were free to kind of have the best analysis possible. So, you know, again Dr. Johnston can refresh my memory to precisely what tweaks there may have been. But I don't want to state that the only difference is in the results because there was an opportunity to have a fresh look at the methodology – fundamentally the

methodology was similar. But they were able to tweak the way they were doing things in order to do the best study possible.
Jill Johnston: Yes, so the major difference is there were 2,055 CAFOs included in the 2014 analysis. And then for the updated analysis based on the permit list there were 2,029. So, you know, that was the major change for facilities that do not undergo permitting or ones that where their permit expired and we do have any evidence that they were going to like renew their permit. What we tried to do in the 2014 analysis was use the best available knowledge we had about which – which CAFOs to include. So we did get some additional information from the state about which ones were not operational and which ones may have had permits but had zero animals housed there. So we did make some adjustment in this first paper to try to anticipate what would be included under the general permits. But in terms of the methodology the analysis and the tables provided are the same. We changed the figures a little bit to try to make them look nicer and we also – there were 20 western counties excluded and that was using the same criteria as we did before. But there was just one additional county that met these criteria.
Mary O'Lone: OK. Yes, OK. Well that was a good explanation. So can we now turn to the – we're going to work from the 2014 (inaudible) you know what we have in front of us. And maybe when you made the changes some of our questions will be answered. But I just – I wanted to start on page 11 just with figure 1. And I have no questions about that. Now I'm moving on to figure 2.
Jill Johnston: OK.
Mary O'Lone: OK. It says the percent of population living within three miles of an IHO in relation to the percent of people of color. Is that the percent of the population in the green study area or the –
Jill Johnston: Yes, so all of the data and all the table and figures provided here are from the study area.
Mary O'Lone: So figure 3. So in the complaint figure 3 is described on page 35 in paragraph 133. I should (inaudible). And I guess the – what we're asking you Dr. Johnston is well I guess do you agree with, that this statements states what your study shows and what that figure shows I guess?
Jill Johnston: Can you read the statement please?
Mary O'Lone: You don't have it? I'm sorry.
Jill Johnston: No, I don't have it, sorry.
Mary O'Lone: It says as shown in the following figure which depicts the relationship of industrial swine facilities to the racial and ethnic composition of North Carolina, swine facilities are clustered in communities of color.
Jill Johnston: Yes, I would agree with that statement.
Mary O'Lone: OK – flipping.
Jill Johnston: And now just to note this becomes figure 2 actually in the updated report. And here we kind of just have three categories of people of color. Anyway it's displayed more closely than how we conduct the analysis in the updated report.
Mary O'Lone: What do you mean? I'm not sure I understand what you mean.
Jill Johnston: (inaudible) – so we actually had like six – six categories that we assign census blocks into six racial categories. And on this map but as original figure in order to simplify it we just show three categories under 20 percent, 20 to 40 percent and then above 40 percent.
Mary O'Lone: We – that was actually a little hard to hear. Can you say that again?

Jill Johnston: I'm sorry. So on this figure, the figure 3 we show – we just showed three categories just that we simplify for purposes of displaying the information which was less than 20 percent, 20 to 40 percent and greater than 40 percent whereas in the updated figure we show all six categories that we use for our analysis. So it's just a minor point and it doesn't impact my interpretation of it.
Mary O'Lone: OK.
Jill Johnston: But just to note if were discussing these changes between the two versions. That was one. We just changed how we displayed the information.
Unknown Female Voice: OK. In the updated version it's figure 2 on page 11.
Jill Johnston: Yes.
Mary O'Lone: OK. So now we're moving on to table 2. So table 2 is – table 2 is discussed in a handful of paragraphs in the complaint. So I guess I will just read them to you one at a time. So this is paragraph 132 on page – I don't know what – wait, 13, so it's 13. No. It's not. What am I talking about? 35, paragraph 132 on page 35 of the complaint. And we are talking about table 2 on page 13 of the study. Paragraph 132 says analysis of the population statewide yields consistent result. The proportions of African Americans, Latino's and Native Americans statewide living within three miles of an industrial swine facility are 1.4, 1.26 and 2.3 times higher than the percentage of non-Hispanic Whites respectively which-Table 2- the disparities are also statistically significant. Is that right?
Unknown Female Voice: Yes.
Mary O'Lone: Table 2.
Unknown Female Voice: I would note that refers to both page 6 and table 2 of the report.
Mary O'Lone: What?
Unknown Female Voice: Paragraph 32, 132.
Unknown Female Voice: OK.
Mary O'Lone: That is basically your sort of quoting page 6. Is that what you're saying?
Unknown Female Voice: I believe so.
Jill Johnston: So that statement I think maybe actually doesn't draw on table 2 that we have shown here which is just for the study area. I think – I believe those numbers that you've read are for the whole state for a statewide analysis where we don't exclude any areas.
Mary O'Lone: OK. So which table should this or is this about? Where are those results displayed?
Unknown Female Voice: It's the first paragraph on page 6, OK.
Jill Johnston: I am not sure of all the tables from our statewide analysis were included in the documents sent to you.
Mary O'Lone: You mean – OK. So the document dated August 29th, 2014, Industrial Hog Operations in North Carolina, what you're saying is there's results discussed in the text that aren't displayed in the table or a figure.
Jill Johnston: Yes, so all the tables and the figures provided in this document are just for the analysis where we restricted it to the study area as (inaudible) –
Mary O'Lone: OK.
Jill Johnston: But there was a parallel analysis that didn't restrict that like included all census blocks in the State of North Carolina and so these results included in the text on page 6 are from that analysis that uses the entire population.
Unknown Female Voice: OK. OK. Just to draw your attention to paragraphs 131 and 132 of the complaint. 131 says analysis based on the study area that excludes the state five major cities in

western counties. And then goes on to give the numbers. And then paragraph 132 by contrast says analysis of the population statewide yields consistent result.
So paragraph131 is about the data in the study area and paragraph 132 says it's consistent but here are the numbers for the state – for a statewide run. Is that correct Jill?
Jill Johnston: Yes.
Jeryl Covington: So 131 again is just for the state –
Jill Johnston: OK.
Jeryl Covington: Or Statewide?
Unknown Female Voice: Paragraph 131 says analysis on a study area so it's for the state but only the study area within the state. And that's what the tables reflect. Paragraph 132, the very first sentence says analysis of the population statewide yields consistent results. So that's – those numbers 1.4, 1.26 and 2.39, which are the same numbers that appear at the top of the report on page 6 first paragraph, is the statewide numbers not just the study area.
Mary O'Lone: So the reference to table 2 is not because those numbers come from table 2. But because table 2 – wait. What is it? It's not about…
Unknown Female Voice: I think the reference to table 2 should probably be like see also. It's – you know I think table, I'm sorry, Page 6 is the actual support whereas table 2 – as Dr. Johnston said seems to be only the study area. Is it all state in the original?
Unknown Female Voice: Well it's racial and ethnic composition of (inaudible) census blocks within three miles of an IHO and more than three miles. So it's the study area excluding the western counties.
Unknown Female Voice: (inaudible) western counties.
Unknown Female Voice: Let me (inaudible) –
Mary O'Lone: OK, so I'm sorry. So this paragraph is basically saying that the statewide results are consistent with table – the proportions are consistent with table 2 which is about the study area?
Unknown Female Voice: Right.
Mary O'Lone: Dr. Johnston is that right?
Jill Johnston: Yes, I'm just, Ok, I'm looking, so yes, I opened up the – I found the document. So yes, so 131 is the proportion, matches within table 2 and then 132 is referring to the state wide analysis with no exclusion areas in which that we did not show the table in this report.
Mary O'Lone: OK, great. We're going to go to – I think so paragraph 140 in the complaint I think it's sort of repeat of that. The statewide proportion of African Americans living within three miles of an industrial swine facility – statewide is 1.4 times higher than the proportion of non-Hispanic whites in that site, table 2 and page – table 2 and page 6.
Jill Johnston: Yes, I believe that's the – that's the same pattern where the one above matches that, the table. In this report, that is the study area, and then 140 versus the statewide analysis.
Mary O'Lone: OK, 142. OK, so the next paragraph then is 142. Are we having the same issue here – the same thing going on? African Americans make up a larger portion – proportion of the population living in proximity to industrial swine (inaudible) than the proportion of the population living within three miles away from any facility with disparity.
Jill Johnston: I believe that (inaudible) compares right that the 20 percent of African American compared to 13 percent of non-Hispanic whites that live within three miles of a CAFO.
Unknown Female Voice: I'm sorry were you quoting again from paragraph 132?
Unknown Female Voice: What are you talking about 142?
Unknown Female Voice: 142, OK, thank you.

Jill Johnston: (inaudible). And it doesn't provide the numbers. But I believe the reference seems appropriate.
Mary O'Lone: OK. And the statement is accurate? 142, OK. Now were moving to 148.
Jill Johnston: Yes, that's the same. That's in reference to the statewide analysis.
Mary O'Lone: OK and that's accurate?
Jill Johnston: Yes.
Mary O'Lone: And 150. (inaudible)
Jill Johnston: Yes, I believe that is correct.
Marianne Engelman Lado: OK. So I'm just trying to reach back and – and Dr. Johnston you may remember as well, these reference to table 2, there are different ways of looking at them. And one maybe that we met kind of the report six provides the information, it's more like a see also table 2 with consistent results. But – but the other way of thinking and I remember that there were lots of charts and tables with the numbers. And I think, and again Dr. Johnston you may remember better than I, we may have taken some charts and tables out simply to make it all more presentable because it was kind of too long and too much. And if we did, could this table 2 have referred to statewide analysis? I just don't remember if there was an earlier draft with more tables, but I seem to have some vague recollection and if so that it may just be kind of typo. But again it's also perfectly consistent, you know, that we may have just thought it's also supported by table 2.
Jill Johnston: You are correct that some variation of all these tables included everything from the study area analysis and then a repeat, you know, maybe like, you know, 2A and 2B or something. I don't remember exactly how we laid it out but some type of study area to the whole state analysis. So it could have drawn on that. And maybe the different iterations change. We try to not have quite as many tables.
Mary O'Lone: Well I'm – this is Mary. I'm beginning to think maybe it would be a good idea to send all the tables in because I know that, you know, there were some questions here about numbers and stuff.
Marianne Engelman Lado: So we could certainly look for any tables that we had that included the statewide analysis which is the piece here and because, you know, if we have something. Also, you know, as these tables were being developed Dr. Wing and Dr. Johnson may have gone back to the data and tweaked, you know, and found that there was a mistake that we included NPDES permits or we included something else that had to be cleaned up. So I don't want to send over stuff that isn't correct, isn't final, right? But because – because they worked on this and as I said before there was a lot of work going into refining the data and then refining the methodology. So but what we can look to see if there were – I do have a recollection that we may have had some near final tables that might have included the statewide data. And we just thought it was too much. So if we have that we can certainly send that over and we'll look for that. I'll put a star next to that as a to-do.
Mary O'Lone: All right, thanks and when – just asking. So the tables don't have headers on them. They're descriptive like the ones that are here. So table 1 is –
Marianne Engelman Lado: I'm not sure were looking for a totally free standing table or is Dr. Johnson said it may have been this table with an additional column. And we just thought it was too confusing to have all that information in one column. It's that kind of thing. So – so it would have a header, you know, if it were a near final version. But I just don't – it's a couple of years ago. And by the time the revisions came long it was more like using this 2014 version as a base so some of these questions weren't revisited again. So its two years ago and I'd have to look

back and confer with Dr. Johnson. But I think there may be something that we can send over to you with statewide data.
Jill Johnston: Yes, we may have to format I'm not sure all the information ended up in this final format but there is a version of the data available.
Mary O'Lone: OK, all right. So turning back –
Marianne Engelman Lado: Just to be clear as I read this and Mary you can correct if you're looking for something that I'm not thinking about or Dr. Johnson correct me if I'm wrong about this. But the data is actually in on page 6. It's just that it's not presented in, you know, in table 2 and the references from table 2 and that's a little confusing. So if we can find that so it, I'm happy to do that. But it doesn't --Dr. Johnson does it change any of your conclusions or is there anything different or new about that data?
Jill Johnston: No, I think it's consistent with what we – with the table that we show. And that, you know, the number and the text and what seems to be in this complaint form are correct.
Mary O'Lone: OK. So, you know, we wanted to – I'm looking at the clock it's five after four. But we wanted to, you know, march through sort of these paragraphs to have you, you know, do what you've been doing so far which is that it's saying yes, that's an accurate characterization of this – this table. And then, you know, after that we have a handful of other questions. But I'm wondering if there's an easier way to do this than just doing it on the phone here so that we can move on to the other kinds of – the other questions that we have. Did you -- Dr. Johnson, did you write these paragraphs that are in the complaint or did you – and or did you – did you write them? That's the first question.
Jill Johnston: No, I did not write them.
Mary O'Lone: OK. Did you review them all before they, you know, came to EPA?
Jill Johnston: I reviewed a version of them. I can't say whether it was the final version or not.
Mary O'Lone: Yes, here's what I'm trying to do. Marianne and I think you probably see what I'm trying to do here. I just want to make sure that – that Dr. Johnson, she didn't write it, but she does agree with what it says. And that's all I'm trying to do to make sure that now when we use it, you know, when we – if we were going to, you know, use the languages in here – that we can adopt it just trying to cross that "T" here.
Marianne Engelman Lado: Let me propose this since Dr. Johnson – we didn't know that this was what you're going to do and Dr. Wing also reviewed these paragraphs. And well, you know, we may have six typos after he reviewed it. He definitely reviewed the final version. I – but perhaps since we didn't expect this line of questioning and Dr. Johnson has a copy of the complaint after the phone call either if you can identify which paragraphs you want her to review –
Mary O'Lone: Sure.
Marianne Engelman Lado: And she can look at them and we can follow up. And if there are any points of divergence of course Dr. Johnson should say so on those paragraphs. But why doesn't she have time to review them and she can get back to us.
Mary O'Lone: Yes, I think that's more efficient.
Marianne Engelman Lado: OK. OK, is that OK with you Dr. Johnson?
Jill Johnston: Yes, I can do that.
Marianne Engelman Lado: OK. Which paragraphs is it or do you want to e-mail us?
Mary O'Lone: We're going to e-mail it. Yes. And we'll have to e-mail you the list. OK, the next question is I think we're already gone. It's hasn't been – the study has – now we're moving off

the, you know, this sticky thing and moving into more general questions. So the study hasn't been published. And you're checking Marianne on whether it was provided to DEQ.
Marianne Engelman Lado: Yes.
Mary O'Lone: OK. And I don't think we need to ask the next two. Do you know has this been made public in other way?
Jill Johnston: I believe that it's on Earth Justice Website.
Mary O'Lone: On the Earth Justice Website?
Jill Johnston: Is that correct?
Mary O'Lone: OK, then maybe I will after next question. Are you aware of any of response or criticisms or critiques of the study, you know, that are out there?
Jill Johnston: I am not and Dr. Wing hasn't shared any with me if he has received something.
Mary O'Lone: Marianne have – have you?
Marianne Engelman Lado: I'm thinking. To be – to be as – as complete as I can but I'm racking my brain and I – I don't think I have received any critique or response for the disproportionality analysis.
Mary O'Lone: OK, all right. Well, you know, if you do come across anything, let us know. OK, now – now I just wanted to talk about the 2000 study. And mainly it's the differences between the 2000 study and the 2014 study. And, you know, sort of why those changes occurred if you know the answer. So, one of the changes was –
Marianne Engelman Lado: I'm sorry before you go in to that, I like you to just hold up the –
Mary O'Lone: Yes.
Marianne Engelman Lado: -- our Website and it look the disproportionality analysis is available through our Website.
Marianne Engelman Lado: Not on our Website? Where?
Unknown Female Voice: North Carolina Policy Watch.
Marianne Engelman Lado: North Carolina Policy Watch.
Unknown Female Voice: OK. Complaint or the study?
Marianne Engelman Lado: The study.
Mary O'Lone: OK, good, OK.
Marianne Engelman Lado: But – OK, then if you heard that the 2014 analysis seems to be available on North Carolina Policy Watch. We – just also so, you know, this is a little bit of an aside from this interview but we have not generally made available the declarations to the press or to other people. We – we in general when we've gotten inquiries we will call the declarant that might have information responsive to an inquiry and ask whether it's OK if we share their declaration, even for people who did not ask to have their information anonymous. I mean it's anonymously and – and as, you know, there was – that – that there was that category as well. But we are, you know, -- we are respectful of people's courage and concerns about retaliation and so we've been very careful not to just throw everything up on the Website. And it doesn't run to the disparities analysis but we haven't just put all the exhibits up on our Website or in any other place. So, that's – that's part of the backdrop as to why I'm not clear to where we sent what.
Mary O'Lone: OK. Did North Carolina Policy Watch just pick this up off of your Website? So, I'm wondering, so you said you haven't received any critiques. I guess I'm wondering or criticisms or, you know, any – anything not off the wall. Could it have gone in to –
Marianne Engelman Lado: North Carolina –
Mary O'Lone: North Carolina Policy Watch.

Elizabeth Haddix: It's a – this is Elizabeth.
Mary O'Lone: Yes.
Elizabeth Haddix: North Carolina Policy Watch picked up the complaint from the Center's website and I'm not recalling any discussion that I had with them. But it would not surprise me at all because they're – they are investigative journalist that they would dig into studies referenced in the complaint and share this with the public. So, in that – since the 2014 study, I mean it was not confidential, it's not surprising that they posted it on their Website.
Unknown Female Voice: And Dr. Wing may have been talking to members of the public and providing copies since it wasn't confidential.
Mary O'Lone: OK.
Elizabeth Haddix: I'm pretty sure that they had also posted the 2000 report a long time – years ago.
Mary O'Lone: Right.
Elizabeth Haddix: So, it – it could be also that they've just been tracking Dr. Wing's work so.
Mary O'Lone: Do you have a relationship with them or they just pick your stuff up and – and they put it up there. Because what I'm wondering is whether they were on the receiving end of anything legitimate as far as the critiques.
Elizabeth Haddix: I do – we do have a relationship with them, a collegial relationship with them so we could find that out if you're interested or.
Mary O'Lone: Yes, we, you know, we're interested – we are interested in it. I mean we're going to look too but we don't know what, you know, if they curate their site or what happened. So, we would be interested if – if they happen to have anything.
Elizabeth Haddix: I'll find out.
Mary O'Lone: OK, sure, great. Thank you. OK, so – so circling back Dr. Johnston to the – to the 2000 study and some of the changes in the methodology from that study to the 2014 study. One of the things that was discussed in the 2000 study had to do with well water. And looking at those that were – you know, somehow including those and now I can't remember because I'm – I'm looking for it now. But that was taken in to account, but that wasn't discussed in the 2014 study.
Jill Johnston: So, my understanding in this report they looked at sort of three different vulnerable populations. One being racial and ethnic minorities, one, do you know looking at people living poverty, and a third looking at people who are relied on well water, but so – the – all the three variables were not included in one model but they were sort of three parallel analyses that looked at the correlation between those different characteristics of the population and proximity to CAFOs.
Mary O'Lone: OK. And the well water component wasn't done in 2014, do you know – is there a lead in –
Jill Johnston: Yes, I mean so specifically we kind of prioritize looking at racial and ethnic disparities in that analysis. And just – just a limited capacity focused specifically on that issue. But also – so the 1990 census included information about people's drinking water sources. But that to my knowledge that is the last census that included that data so if we wanted to look at data in, you know, in the 2020, I 'm sorry in the 2010 census, they did not include questions asking about drinking water.
Mary O'Lone: All right, great, thank you.
Marianne Engelman Lado: It's like this is Marianne if I could just interject, so because this is – this was not a general study for the general public but a study to test whether there was a racial

disparity related to the general permit, the – the request was to examine that question, whether there are disparities on the basis of race and ethnicity. So, you know, there's a difference between doing a study, you know, for the general inquiry of, you know, of vulnerable populations and – and their relationship to CAFOs and looking into the relationship on the basis of race and ethnicity and whether the civil rights law is violated. So, it was really a question as to whether or not there was a disparity that cognizable under the civil rights law that, you know, that Dr. Wing and – and Dr. Johnson generously took up. So, that you know, -- that's a big part of it here.

Mary O'Lone: OK. Yes, I – I understand what you're saying Marianne. OK, the – so the next question it has to do with the distance and we talked about a little bit earlier. And I think that 2000 study did one and two mile buffers and now this one goes to three so can you – can you – and the next one has to do – the next question I have has to do with the measurement. The idea of moving off the buffer zones around the, the block group area to using the centroid. So, I mean maybe it's all related but if you could explain that.

Jill Johnston: Yes, yes so a major difference between the – for the spatial approach that we took in these two different reports is in the 2000 reports they relied on block groups. And so here there was a little over 4,000 black groups included I believe in the study area. And so, with our report we have over 200,000 blocks in our study area. So, the size of the blocks and the size of the block groups are very different especially in rural areas because they sort of (inaudible) to have, you know, similar types of populations in terms of counts in the – in these different census like geographic areas. And so in rural areas the block groups tend to be very big and so – so they were looking at the – the principal analysis in this 2000 report wanted to see if there was any CAFO in the block groups. And then as sort of a sensitivity approach because, you know, you can have a CAFO right in the corner of a block group and so that could impact it's neighboring block groups as well or a proportion of that population. So, as a sensitivity approach they also looked at, sort of one mile around the block group and then two miles around the block group and included, you know, the category of whether or not it was near a CAFO or (inaudible) adjusted based on those parameters. So, in contrast when you look at blocks, I don't remember the exact number but, you know, there's a little over 2,000 CAFOs in the state so if we were just to assign exposure based on whether or not there was a CAFO in the block, you know, that went down to like fewer than a thousand blocks because they're just much smaller. And so for – for this analysis it – when – when you're using blocks as your unit of analysis then – then you need to consider, I mean, we believe it's important to consider, a buffer zone around it because we know how chemicals can travel off-site. And so, you know, using evidence, a lot of papers that have been published since 2000, we sort of relied on a – a three mile buffer for the 2014 report. But that is – I mean the – the spatial scale of the two are just, are just very different and so that's part of these (inaudible) what kind of buffers were considered.

Jeryl Covington: Let – let me ask a question– and this is Jeryl so I'm – I'm understanding that you all looked the block group and you are still considering I guess the travel, the air emissions of H2S, you all didn't overlay on this one as well to come up with that distance.

Jill Johnston: On the 2000 report?

Jeryl Covington: Yes.

Jill Johnston: So, the choice of the one and two mile buffers I cannot specifically speak to.

Jeryl Covington: OK.

Jill Johnston: As our part – I believe the data presented here in the table don't specifically include the buffer zone but that was used as a sensitivity analysis. So, if we included these buffers or change their definition of exposure with the patterns that we see changed and – and from my understanding of this report, you know, the patterns were – were consistent but I believe the tables show, rely on the definition of that, of block group is exposed if there's a CAFO in that block group.
Jeryl Covington: I'm going to repeat that. So, you're saying the block group is exposed if there is a CAFO in that block group?
Jill Johnston: Yes, that was the primary definition of the analysis from – from my understanding in this 2000 report.
Mary O'Lone: And the one and two mile buffer around the block group, was not that populations were measured one and two miles outside of that block group? For some other reason.
Female: Yes, so it would take – so perhaps there would be no CAFO in a block group.
Mary O'Lone: OK.
Jill Johnston: But if you do a one mile buffer around it there would be a CAFO. So, under that condition you would include that block group as this population is exposed to a CAFO. And – it doesn't specify I assume because it's block group that's using like around the – one mile around the buffer rather one mile from the centroid.
Mary O'Lone: Yes.
Jill Johnston: Because – you know, because block groups are so much bigger so – so you wouldn't get much outside the borders with that definition.
Unknown Female Voice: Dr. Johnston –
Jill Johnston: Yes.
Unknown Female Voice: And so just to – just to make sure I have it and it's clear when you say you would include that CAFO that's in the buffer up to two miles away in exposure that would be in the sensitivity analysis but not in – I don't know what you call it but the core analysis.
Jill Johnston: Yes, that's how, you know, I don't want to say 100 percent because I did not make these tables. But as I read this paper and how I understand the data presented is they're not using the – the buffered definition. They're – they're just using the category of whether or there's any CAFO inside the block group.
Mary O'Lone: OK, OK, anybody else? All right so the next question and Marianne, I think this probably goes back to what you've already said but, why was poverty omitted this time?
Jill Johnston: Yes, I think it goes back to the same point is that we were, you know, looking at – at criteria that were considered under the – the civil rights act.
Mary O'Lone: OK.
Jill Johnston: And – and so, you know, poverty not being one of those classes considered we didn't include it in the analysis.
Mary O'Lone: OK. Are there any other differences that you by chance know about between the 2000 and the 2014?
Jill Johnston: I mean, you know, the – how we assigned which people were exposed were different. Also this analysis includes all commercial CAFOs in the state of North Carolina whereas the 2014 we restricted to those CAFOs that are covered under the general permit. So, it does not include ones under the individual permits or under NPDES.

Unknown Female Voice: Ok.
Unknown Female Voice: Didn't you Dr. Johnston, explain what you mean by how the – how people are assigned. Are you referring to the use if quintiles and can you explain what the significance of that is.
Jill Johnston: Yes, so actually now (inaudible) – you're considered to be exposed to a CAFO if you live in a block group with the CAFO, you know, whereas in our – in our 2014 report, you're considered to be exposed to a CAFO if you're – the centroid of your block is within three miles of a CAFO.
Unknown Female Voice: Right.
Jill Johnston: But, yes, here also the – we – we take a similar approach to using your categorical variables to account for non-linearity in the relationship between, you know, the racial composition and proximity or exposure to CAFOs. But in this 2000 analysis they divide the group so that in each of the prior groups there's an equal number of block groups in it. So, that's how they defined their power point. So, for example like the – what was quintile is (inaudible) to 2.3 percent, the highest quintile is more than 44 percent people of color. Whereas in the updated (inaudible) we used partly just – because we thought it was a little bit more intuitive and easier to understand, we categorized the percent people of color in to equal – like equal percentages. So, our reference group was the zero percent people of color because that was a high percentage of population where they live in blocks with no people of color and then divided it from, you know, more than zero to 20 – 20 to 40 in this group of 20 percent. Because it's – it's a low risk I think easier to communicate rather than having to talk about, you know, this quintile versus that quintile and also because then we're able to look at, you know, these census blocks that are majority people of color.
Unknown Female Voice: So, Dr. Johnston so that the – just a follow up on that. So, that if you used quintile it would have – would you – it would have been difficult to say anything meaningful about the effect of living in a – over 60 percent versus over 80 percent people of color community but using your methodology you could get more granular on that basis? Is that – is that right?
Jill Johnston: Right
Unknown Female Voice: I didn't hear the answer.
Jill Johnston: I'm sorry. Yes, that is correct.
Unknown Female Voice: Ok.
Mary O'Lone: OK. Anybody else have any other questions, comments? OK. So, the 2000 study and – and, you know, maybe you – you may not be able to answer this but are you aware of any criticisms of that study? So, I think that – wasn't that submitted in one of the general permit processes? So, I'm wondering if it got more play in the outside world then if, you know, what reaction there may have been to that that you're aware of or critiques?
Jill Johnston: I mean it was published in Environmental Health Perspectives which is a high quality journal in environmental health and went through a peer review process. But I can't speak to any of critiques of it.
Mary O'Lone: OK. All right, where are we now? I think we're close to wrapping up here. We have a general – one – one last – one question here is the – is the generic one that's – that's all experts get asked and you probably seen it on TV which is the – you know, were you compensated for doing the study.
Jill Johnston: No. No, I was not.

Mary O'Lone: OK. And the other question I have – I heard somebody laughing, were wondering if – if you had worked with Dr. Wing on any other studies related to swine and – and swine farms of North Carolina.
Jill Johnston: Yes, I worked with him and also Dr. Guidry around an analysis of hydrogen sulfide concentrations near middle schools in Eastern North Carolina which was recently published.
Mary O'Lone: OK, that was – I think that is in your CV or was referenced in your CV, is that right?
Jill Johnston: Yes, yes.
Marianne Engelman Lado: And – and I was just going to interject here that that work and – and Dr. Johnson's experience working on studies generally community based participations studies and other work in the community on which she might base opinions about the adverse impact of – of swine (inaudible) could be subject to another interview as we kind of went back and forth on – that wasn't kind of the premise of this interview but –
Mary O'Lone: Right.
Marianne Engelman Lado: But she's generously said that, you know, if – if she knows in advance that she'd be more than happy to talk to you about that body of work and the research associated with it.
Mary O'Lone: OK, that would be great. Did – did the hydrogen sulfide study get submitted with the materials you sent in April Marianne?
Marianne Engelman Lado: Yes, it is the study that is – it was confidential at the time but it has since been published. So, it – it's – it exhibit but it also says it's confidential.
Mary O'Lone: OK, so –
Marianne Engelman Lado: It was pre-publication at that point.
Mary O'Lone: We have a – the – I'm trying to find – do we can – can send us the publication copy just to make it easy?
Marianne Engelman Lado: Yes.
Mary O'Lone: For us the – the published version, that would be great. You have any other questions right now, do you have another one? I don't think so. Is there – is there anything else that – that you wanted to add Dr. Johnston?
Jill Johnston: You don't – no, I don't believe so, I think if you have a chance to review our updated report then I'm happy to answer any questions or if there are any clarifications related to that but it – it I was a pretty parallel structure to what you have, we just refined the- which CAFOs were in included in the analysis.
Mary O'Lone: OK , and so, yes, and I'm kind of thinking Marianne since I haven't had a chance to look at it that, you know, how we were going to send you the paragraph that we wanted to do. I have a feeling we're going to have to– we have to fix it because we have to switch it now to the – to the newer study. So, the a newer study – what you submitted Marianne, is it going to include – is it just a new study or do you have a cover letter that it's like the complaint that goes through and, you know, here's the – here's the layman, you know, description of what is in – the support.
Marianne Engelman Lado: So, it's a little bit of a hybrid in the sense that we have the complaint and we're – we're filing additional submissions in support of the allegations in the complaint. We don't amend the complaint and say this goes to paragraph 132, we rather are just submitting additional documentation in support of those allegations. So, there is a – a short cover letter but it's not – it's not lengthy and, you know, doesn't go in to which paragraph that it supports.

Mary O'Lone: OK.
Marianne Engelman Lado: OK, the other thing I was thinking might be useful since we're ending up a little bit early which is good is just to say a little bit more about Dr. Johnston's experienced, you know, and background and expertise on methodological issues and, you know, -- and of courses taught-- or research done or you have her CV and I think Jeryl Covington asked some questions earlier on but if you have any questions about that – or I would just open up to Dr. Johnston to say a few more words about whether you have taken any courses or have any special training or expertise on methodology in epidemiology and public health.
Jill Johnston: Sure. I mean I guess the starting point is, you know, that's – this was not submitted to the peer review process but there's a recent publication that – that I authored in the American Journal of Public Health. That – that sort of uses are very similar approach to a racial disparities analysis. It's around a different topic looking at waste water disposal wells in – in South Texas so not related to industrial animal operations. But, you know, went through the peer review process used block level data and – and a very similar approach to that. So, there is some, you know, some of – some of that sort of expertise and – and credentials in the peer reviewed literature that – that is similar methods to what we're doing here in this paper. You know, but also, yes I mean I do have fairly expensive course work and the – these different types of – of progression modeling, epidemiological study design and also just quantitative data analysis, processes like both in, you know, in biostatistics and epidemiology and then also in the econometrics. And – and then, you know, I had a two year post-doctoral fellowship in environmental epidemiology and – and co-taught a class with Dr. Wing specifically on community based epidemiological methods and environmental justice.
Mary O'Lone: OK, well thank you actually that was helpful particularly to the reference to the West Texas or the – the –
Jill Johnston: Yes, so that article I mean I can send it to you but it's also included in my CV and, yes, may be helpful I – I think (inaudible) critiques on – on the – from the oil industry but nothing that – that was really methodological driven but – but yes that can – it's – it's a reference in the peer reviewed literature that's – that takes a very similar approach to – to how to analyze data in a racial disparities analysis as this one does.
Mary O'Lone: OK, is it – is it easy for you to send us that report too? Because that – that –
Jill Johnston: Yes.
Mary O'Lone: -- I think that would be helpful and then –
Jill Johnston: Then maybe I could send it to Marianne and then – and in her package she can share with you.
Marianne Engelman Lado: Yes.
Mary O'Lone: Great. And the – the oil and gas industry comments or response or whatever you want to call it. How – like what form did that take?
Jill Johnston: It came out to a reporter that shared it to me – with me.
Mary O'Lone: Can – would you be willing to share that as well?
Jill Johnston: Yes, let me – let me review it but probably –
Mary O'Lone: OK. OK, did anybody else have any questions at this point? OK.
Marianne Engelman Lado: So, we – we have some follow up, we have some things to give you, we'll wait for your list of paragraphs as well and exchange information and then it sounds like on – on the – the follow up report that was submitted this year as well as the more recent study, as well as other studies and work on the adverse impacts, we should schedule another

interview time. And we can try to do that relatively quickly I think if – if you'd like so let's try to get that all under way.
Mary O'Lone: Yes, I think we'll have to – to get back to you on that.
Jeryl Covington: Yes, yes Marianne what I – what I have identified so far is that you will be sending after you review the background, the statewide study so that we can correlate the tables and the statewide data that you have in the – in the report. We will follow up on whether that questions for the paragraphs are relevant. We need to review the data that you just sent to us on April 12, 2016 to see if those questions have been answered. So, we'll have to review that e-mail and I did receive those e-mail submission. So, let us look at that and then we'll probably coordinate amongst ourselves on the follow up interview with Dr. Johnston and yourself.
Marianne Engelman Lado: Sure (inaudible) if you could send me some dates. I – I think what we said on the statewide data is if there are final charts again, I think it's just a reference problem in the complaint to this table 2–
Jeryl Covington: Yes.
Marianne Engelman Lado: If there was another table 2 with the state wide data or another table with the state wide data or another column in an earlier draft that, you know, sufficiently well along, we'd be happy to send it to you.
Jeryl Covington: OK.
Marianne Engelman Lado: But we will – we'll look for that and get back to you on that.
Jeryl Covington: OK. And then – the follow up we did receive in the April 12 submission the Guidry report that is marked confidential and I think you're going to submit that after publication without the confidential reference to it.
Marianne Engelman Lado: Correct.
Jeryl Covington: And then Dr. Johnston is going to do the supplementary information on the oil and gas disparity analysis literature to you and then you'll subsequently submit that to us.
Unknown Female Voice: So, I think it would be the publication as well as she's going to review the feedback she got to see if it's appropriate to forward.
Unknown Female Voice: Right.
Jeryl Covington: Right. OK.
Marianne Engelman Lado: Terrific. OK, OK. Thank you.
Mary O'Lone: Yes, I think that's it for now.
Unknown Female Voice: OK.
Marianne Engelman Lado: OK.
Mary O'Lone: All right thank you very much and thank you Dr. Johnston.
Jill Johnston: All right thank you.
Mary O'Lone: OK, bye-bye.
Operator: The leader has disconnected, the conference will now end.
END

## O'Lone, Mary

**From:** Golightly-Howell, Velveta
**Sent:** Friday, April 10, 2015 2:26 PM
**To:** Shapiro, Mike
**Cc:** Simons, Vicki; Dorka, Lilian; Wooden-Aguilar, Helena; Packard, Elise; Rhodes, Julia; Matthew, Dayna; O'Lone, Mary
**Subject:** REACH (Assistance Request)

**Importance:** High

Hi Mike. I hope that your day is starting well.

While this information is not for public consumption, I wanted to let you know that both parties in the REACH complaint have agreed to begin the process of selecting a mediator for the ADR process. The parties' agreement to the mediator is the point at which OCR will send a letter to the parties saying it has tolled the 180-day deadline in EPA's regulations for completing the investigation and put the investigation in an "on hold" status. It could take several weeks (or more) to get to that point. Since there is always a possibility that agreement may not be reached on a mediator, OCR will continue internally working the investigation. To that end, I ask that you please provide OCR with a Title VI point of contact who has the to the ability to quickly marshal the appropriate technical expertise within your office to assist in investigatory tasks (*e.g.,* review studies, assist in analysis). At this point, we do not know specifically what technical assistance we may need, but appreciate your willingness to help.

Also, OCR would like to also be able to tap into existing EPA expertise in CAFO issues. We are looking for program staff who have the background and experience to assist us should we need to navigate what we anticipate will be controversial and potentially high-profile issues. If you would please provide us with a CAFO contact that we could consult with on an as-needed basis on sensitive issues, it would be most appreciated.

Once you provide the names to Mary O'Lone and me, Mary will grant them access to the SharePoint site.

Also, we have already seen press interest in the complaint. Should anyone on OWOW receive a press inquiry about the REACH complaint, please refer any press inquiries directly to Jennifer Colaizzi in OPA (202-564-7776). Jennifer is prepared to field all inquiries.

Thanks so much in advance for your assistance!

Velveta

Velveta Golightly-Howell
Director, Office of Civil Rights
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Mail Code 1201A
Washington, DC 20460
202-564-6685

## O'Lone, Mary

**From:** Golightly-Howell, Velveta
**Sent:** Monday, March 07, 2016 4:01 PM
**To:** Fritz, Matthew; Pieh, Luseni; Reeder, John; Lapierre, Kenneth; Purchia, Liz; Rupp, Mark; Carleton, Ron; Ali, Mustafa; Tejada, Matthew
**Cc:** Smith, Roxanne; Hall, William; Dorka, Lilian; Wooden-Aguilar, Helena; Covington, Jeryl; Farrell, Ericka; Temple, Kurt; Packard, Elise; Rhodes, Julia; O'Lone, Mary; Harrell, Collette; Lee, Charles
**Subject:** EPA OCR Complaint 11R-14-R4 (ADR)

Hello Matt F., Lu, John, Ken, Liz, Mark, Ron, Mustafa and Matt T. I'm writing to let you know that this morning, Marianne Lado Engelman of Earthjustice, the lead representative for complainants contacted me regarding REACH. the Title VI discrimination complaint which alleges race and national origin discrimination related to swine feeding operations in North Carolina. Ms. Lado Engelman advised that the complainants have concluded that ADR is unproductive; they therefore request that OCR reinitiate its investigation. In requesting recommencement of the investigation, Ms. Lado Engelman stated:

> "Finally, we wanted to mention that our initial mediation session was interrupted by an effort by the National and North Carolina Pork Councils to interject themselves into the mediation process. Despite the terms of ADR, which included a requirement that mediation be confidential, and despite our clear opposition to their self-styled "motion to intervene" in the complaint and mediation process, five representatives from the Pork Council appeared without notice to Complainants at the first mediation session. Their presence and insistence at playing a role in mediation delayed the start of our session and acted as a form of intimidation of our clients. Representatives from DEQ failed to object to the behavior. Indeed, quite the opposite, they tried to persuade Complainants to consent to bringing the Pork Councils into mediation. We thought it was relevant and important to bring these events to your attention."

FYI, in response to the councils' request to intervene in ADR, in or about January, I notified the requesters that the parties would have to agree to include them and that OCR does not participate in ADR. Ms. Lado Engelman was copied on the response.

As ADR has ended, OCR will relaunch its complaint investigation. Please don't hesitate to let me know if you have any questions.

Velveta

Velveta Golightly-Howell
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Washington, DC 20460
202-564-7272

## O'Lone, Mary

**From:** Farrell, Ericka
**Sent:** Thursday, April 21, 2016 2:43 PM
**To:** O'Lone, Mary
**Subject:** FW: EPA OCR Complaint 11R-14-R4 (ADR)

**From:** Golightly-Howell, Velveta
**Sent:** Monday, March 07, 2016 4:01 PM
**To:** Fritz, Matthew <Fritz.Matthew@epa.gov>; Pieh, Luseni <Pieh.Luseni@epa.gov>; Reeder, John <Reeder.John@epa.gov>; Lapierre, Kenneth <Lapierre.Kenneth@epa.gov>; Purchia, Liz <Purchia.Liz@epa.gov>; Rupp, Mark <Rupp.Mark@epa.gov>; Carleton, Ron <Carleton.Ron@epa.gov>; Ali, Mustafa <Ali.Mustafa@epa.gov>; Tejada, Matthew <Tejada.Matthew@epa.gov>
**Cc:** Smith, Roxanne <Smith.Roxanne@epa.gov>; Hall, William <Hall.William@epa.gov>; Dorka, Lilian <Dorka.Lilian@epa.gov>; Wooden-Aguilar, Helena <Wooden-Aguilar.Helena@epa.gov>; Covington, Jeryl <Covington.Jeryl@epa.gov>; Farrell, Ericka <Farrell.Ericka@epa.gov>; Temple, Kurt <Temple.Kurt@epa.gov>; Packard, Elise <Packard.Elise@epa.gov>; Rhodes, Julia <Rhodes.Julia@epa.gov>; O'Lone, Mary <o'lone.mary@epa.gov>; Harrell, Collette <Harrell.Collette@epa.gov>; Lee, Charles <Lee.Charles@epa.gov>
**Subject:** EPA OCR Complaint 11R-14-R4 (ADR)

Hello Matt F., Lu, John, Ken, Liz, Mark, Ron, Mustafa and Matt T. I'm writing to let you know that this morning, Marianne Lado Engelman of Earthjustice, the lead representative for complainants contacted me regarding REACH. the Title VI discrimination complaint which alleges race and national origin discrimination related to swine feeding operations in North Carolina. Ms. Lado Engelman advised that the complainants have concluded that ADR is unproductive; they therefore request that OCR reinitiate its investigation. In requesting recommencement of the investigation, Ms. Lado Engelman stated:

> "Finally, we wanted to mention that our initial mediation session was interrupted by an effort by the National and North Carolina Pork Councils to interject themselves into the mediation process. Despite the terms of ADR, which included a requirement that mediation be confidential, and despite our clear opposition to their self-styled "motion to intervene" in the complaint and mediation process, five representatives from the Pork Council appeared without notice to Complainants at the first mediation session. Their presence and insistence at playing a role in mediation delayed the start of our session and acted as a form of intimidation of our clients. Representatives from DEQ failed to object to the behavior. Indeed, quite the opposite, they tried to persuade Complainants to consent to bringing the Pork Councils into mediation. We thought it was relevant and important to bring these events to your attention."

FYI, in response to the councils' request to intervene in ADR, in or about January, I notified the requesters that the parties would have to agree to include them and that OCR does not participate in ADR. Ms. Lado Engelman was copied on the response.

As ADR has ended, OCR will relaunch its complaint investigation. Please don't hesitate to let me know if you have any questions.

Velveta

Velveta Golightly-Howell
Director, Office of Civil Rights
Environmental Protection Agency

1200 Pennsylvania Avenue, N.W.
Mail Code 1201A
Washington, DC 20460
202-564-7272

## O'Lone, Mary

**From:** Shaw, Betsy
**Sent:** Thursday, March 10, 2016 9:20 AM
**To:** Golightly-Howell, Velveta
**Cc:** Dorka, Lilian; Covington, Jeryl; Farrell, Ericka; Temple, Kurt; Packard, Elise; Rhodes, Julia; O'Lone, Mary; Harrell, Collette; Shapiro, Mike; Starfield, Lawrence; Koerber, Mike; Schrock, Bill
**Subject:** RE: EPA OCR Complaint 11R-14-R4 (ADR)

Hi Velveta,

The points of contact for OAR will be Bill Schrock and Mike Koerber in OAQPS.

Thanks,

Betsy

---

**From:** Golightly-Howell, Velveta
**Sent:** Wednesday, March 09, 2016 11:58 AM
**To:** Shaw, Betsy <Shaw.Betsy@epa.gov>; Shapiro, Mike <Shapiro.Mike@epa.gov>; Starfield, Lawrence <Starfield.Lawrence@epa.gov>
**Cc:** Dorka, Lilian <Dorka.Lilian@epa.gov>; Covington, Jeryl <Covington.Jeryl@epa.gov>; Farrell, Ericka <Farrell.Ericka@epa.gov>; Temple, Kurt <Temple.Kurt@epa.gov>; Packard, Elise <Packard.Elise@epa.gov>; Rhodes, Julia <Rhodes.Julia@epa.gov>; O'Lone, Mary <o'lone.mary@epa.gov>; Harrell, Collette <Harrell.Collette@epa.gov>
**Subject:** EPA OCR Complaint 11R-14-R4 (ADR)

Hello Betsy, Mike and Larry. I'm writing to let you know that Marianne Lado Engelman of Earthjustice, the lead representative for complainants, has contacted me regarding REACH. the Title VI discrimination complaint which alleges race and national origin discrimination related to swine feeding operations in North Carolina. Ms. Lado Engelman advised that the complainants have concluded that ADR is unproductive; they therefore request that OCR reinitiate its investigation. In requesting recommencement of the investigation, Ms. Lado Engelman stated:

> "Finally, we wanted to mention that our initial mediation session was interrupted by an effort by the National and North Carolina Pork Councils to interject themselves into the mediation process. Despite the terms of ADR, which included a requirement that mediation be confidential, and despite our clear opposition to their self-styled "motion to intervene" in the complaint and mediation process, five representatives from the Pork Council appeared without notice to Complainants at the first mediation session. Their presence and insistence at playing a role in mediation delayed the start of our session and acted as a form of intimidation of our clients. Representatives from DEQ failed to object to the behavior. Indeed, quite the opposite, they tried to persuade Complainants to consent to bringing the Pork Councils into mediation. We thought it was relevant and important to bring these events to your attention."

FYI, in response to the councils' request to intervene in ADR, in or about January, I notified the requesters that the parties would have to agree to include them and that OCR does not participate in ADR. Ms. Lado Engelman was copied on the response.

As ADR has ended, OCR will relaunch its complaint investigation. Shortly after OCR began the investigation, you provided POCs for your office. We realize that they may have changed. Would you please provide the names of current POCs ASAP and by Friday, 3/18?

Thank you for your ongoing assistance!

Velveta

Velveta Golightly-Howell
Director, Office of Civil Rights
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Washington, DC 20460
202-564-6685

**Air Studies Related to Swine CAFOs (* indicates apparent NC focus)**

**Studies submitted as Exhibits**

*Marion Deerhake et al., *Atmospheric Dispersion and Deposition of Ammonia Gas*, *in* RTI Int'l, Benefits of Adopting Environmentally Superior Swine Waste Management Technologies in North Carolina: An Environmental and Economic Assessment, at 2-32 to 2-34 (2003), *available at* http://www.cals.ncsu.edu/waste_mgt/smithfield_projects/phase1report04/appendix%20c-RTI.pdf, attached as **Exhibit 47** (modeling rates of ammonia deposition by county). "The greatest deposition occurs in Sampson and Duplin counties." *Id.* at 2-33.

*Maria C. Mirabelli et al., *Asthma Symptoms Among Adolescents Who Attend Public Schools That Are Located Near Confined Swine Feeding Operations*, 118 Pediatrics e66 (2006), attached as **Exhibit 42** (finding students aged 12 to 14 who attended North Carolina public schools within 3 miles of industrial swine facilities reported increased asthma-related symptoms, more doctor-diagnosed asthma, and more asthma-related medical visits compared to peers at other schools).

*Maria C. Mirabelli et al., *Race, Poverty, and Potential Exposure of Middle-School Students to Air Emissions from Confined Swine Feeding Operations*, 114 Envtl. Health Perspectives 591, 595 (2006), attached as **Exhibit 43** (finding that North Carolina's swine facilities are located closer to schools enrolling higher percentages of non-white and economically disadvantaged students).

*Leah Schinasi et al., *Air Pollution, Lung Function, and Physical Symptoms in Communities Near Concentrated Swine Feeding Operations*, 22 Epidemiology 208, 208 (2011), attached as **Exhibit 48** (measuring pollutants levels and effect on 101 adults living near hog CAFOs in 16 eastern North Carolina communities).

*Sacoby M. Wilson & Marc L. Serre, *Examination of Atmospheric Ammonia Levels Near Hog CAFOs, Homes, and Schools in Eastern North Carolina*, 41 Atmospheric Env't 4977, 4985 (2007), attached as **Exhibit 49**.

*Steve Wing et al., *Air Pollution and Odor in Communities Near Industrial Swine Operations*, 116 Envtl. Health Perspectives 1362 (2008), attached as **Exhibit 50** (study participants living within 1.5 miles of swine factory farm reported altering or ceasing normal daily activities when hydrogen sulfide concentrations, and associated hog odor, were the highest) [Wing, *Air Pollution and Odor*].

*Steve Wing et al., *Air Pollution from Industrial Swine Operations and Blood Pressure of Neighboring Residents*, 121 Envtl. Health Perspectives 92 (2013), attached as **Exhibit 51**.

*Steve Wing & Jill Johnston, Dep't of Epidemiology, Univ. of N.C. at Chapel Hill, *Industrial Hog Operations in North Carolina Disproportionately Impact People of Color* (2014) attached as **Exhibit 4.**

**Cited in Complaint, but copy not provided.**

Julia R. Barrett, *Airborne Bacteria in CAFOs: Transfer of Resistance from Animals to Humans*, 113 Envtl. Health Perspectives A116 (2005) (reviewing literature on cross-species transfer of antibiotic-resistant bacteria).

Amy Chapin et al., *Airborne Multidrug-Resistant Bacteria Isolated from a Concentrated Swine Feeding Operation*, 113 Envtl. Health Perspectives 137 (2005) (finding multidrug-resistant *Enterococcus*, coagulase-negative staphylococci, and viridans group streptococci in the air of an industrial swine operation at levels dangerous to human health).

Jennifer K. Costanza et al., *Potential Geographic Distribution of Atmospheric Nitrogen Deposition from Intensive Livestock Production in North Carolina, USA*, 398 Sci. Total Env't 76, 77 (2008).

Shawn G. Gibbs et al., *Isolation of Antibiotic-Resistant Bacteria from the Air Plume Downwind of a Swine Confined or Concentrated Animal Feeding Operation*, 114 Envtl. Health Perspectives 1032 (2006).

Shawn G. Gibbs et al., *Airborne Antibiotic Resistant and Nonresistant Bacteria and Fungi Recovered from Two Swine Herd Confined Animal Feeding Operations*, 1 J. Occupational & Envtl. Hygiene 699 (2004) (finding multidrug-resistant bacteria inside and downwind of industrial swine operations at levels previously determined to pose a human health hazard).

Rachel Avery Horton et al., *Malodor as a Trigger of Stress and Negative Mood in Neighbors of Industrial Hog Operations*, 99 Am. J. Pub. Health Suppl., S610 (2009).

James A. Merchant et al., *Asthma and Farm Exposures in a Cohort of Rural Iowa Children*, 113 Envtl. Health Perspectives 350 (2005) (finding children living on swine farms, including large facilities with more than 500 head, experienced increased rates of asthma compared to non-exposed children; results more pronounced where swine facilities added antibiotics to feed).

Katja Radon et_al., *Environmental Exposure to Confined Animal Feeding Operations and Respiratory Health of Neighboring Residents*,18 Epidemiology 300 (2007) (surveying nearly 7,000 residents of four German towns with high confined livestock operation densities and concluding that such operations "may contribute to the burden of respiratory disease among their neighbors"). (Footnoted in Earthjustice comments on draft permit).

C.A. Rotz, *Management to Reduce Nitrogen Losses in Animal Production*, 82 J. Animal Sci. E119, E129 (2004).

Ana M. Rule et al., *Assessment of an Aerosol Treatment To Improve Air Quality in a Swine Concentrated Animal Feeding Operation,* 39 Envtl. Sci. & Tech., 9649, 9649 (2005).

Matias B. Vanotti & Patrick G. Hunt, Ammonia Removal from Swine Wastewater Using Immobilized Nitrifiers, *in* Proceedings of the 8th Int'l. Conf. of the FAO ESCORENA Network on Recycling of Agricultural, Municipal and Industrial Residues in Agriculture, Rennes, France 427, 428 (1998), *available at* http://www.ramiran.net/doc98/FIN-ORAL/VANOTTI.pdf.

James A. Zahn et al., *Air Pollution from Swine Production Facilities Differing in Waste Management Practice* 3, Proceedings of the Odors and Emission 2000 Conference (2000) (listing all types of "emissions released from stored swine manure" mentioned above).

*John T. Walker et al., *Atmospheric Transport and Wet Deposition of Ammonium in North Carolina*, 34 Atmospheric Env't 3,407 (2000).

*Susan S. Schiffman et al., *Quantification of Odors and Odorants from Swine Operations in North Carolina*, 108 Agric. & Forest Meteorology 213 (2001).

Susan S. Schiffman et al., *Symptomatic Effects of Exposure to Diluted Air Sampled from a Swine Confinement Atmosphere on Healthy Human Subjects*, 113 Envtl. Health Perspectives 567 (2005) (finding that those exposed to diluted swine air for two 1-hour sessions were more likely to report headaches, eye irritation, and nausea than the control group that was exposed to clean air); http://www.ncbi.nlm.nih.gov/pubmed/15866765.

Wing S, Horton RA, Marshall SW, Thu K, Tajik M, Schinasi L, et al. 2008. *Air Pollution and Odor in Communities Near Industrial Swine Operations.* Environ. Health Perspect. 116:1362-1368.

*Sacoby M. Wilson & Marc L. Serre, *Use of Passive Samplers to Measure Atmospheric Ammonia Levels in a High-density Industrial Hog Farm Area of Eastern North Carolina*, 41 Atmospheric Env't 6,074 (2007).

**Studies not listed above but Earthjustice cited in their 2013 comments on draft Swine Permit**

*Rachel Avery et al., *Odor from Industrial Hog Farming Operations and Mucosal Immune Function in Neighbors*, 59(2) Archives of Envtl. Health 101 (2004) (finding that swine odor was associated with reduced mucosal immune function among 15 adults living near industrial swine operations in North Carolina).

**Studies not listed above cited in Exhibit 4 (**Steve Wing & Jill Johnston, Dep't of Epidemiology, Univ. of N.C. at Chapel Hill, *Industrial Hog Operations in North Carolina Disproportionately Impact People of Color* (2014)).

Donham K. 1993. *Respiratory Disease Hazards to Workers in Livestock and Poultry*

*Confinement Structures*. Seminars in Respiratory Medicine 14:49-59.

Donham K, Reynolds S, Whitten P, Merchant J, Burmeister L, Popendorf W. 1995. *Respiratory Dysfunction in Swine Production Facility Workers: Dose-response Relationships of Environmental Exposures and Pulmonary Function*. American Journal of Industrial Medicine 27:405-418.

Donham K, Cumro D, Reynolds S, Merchant J. 2000. *Dose-Response Relationships Between Occupational Aerosol Exposures and Cross-Shift Declines of Lung Function in Poultry Workers: Recommendations for Exposure Limits*. Journal of Occupational and Environmental Medicine 42:260-269.

Green CF, Gibbs SG, Tarwater PM, Mota LC, Scarpino PV. 2006. *Bacterial Plume Emanating from the Air Surrounding Swine Confinement Operations*. Journal of Occupational and Environmental Hygiene 3:9-15.

Schiffman SS, Sattely Miller EA, Suggs MS, Graham BG. 1995. *The Effect of Environmental Odors Emanating from Commercial Swine Operations on the Mood of Nearby Residents*. Brain Research Bulletin 17:369-375.

Tajik M, Muhammad N, Lowman A, Thu K, Wing S, Grant G. 2008. *Impact of Odor from Industrial Hog Operations on Daily Living Activities.* New Solututions 18:193-205.

**Other studies I came across**

*Yelena Ogneva-Himmelberger *, Liyao Huang and Hao Xin, *CALPUFF and CAFOs: Air Pollution Modeling and Environmental Justice Analysis in the North Carolina Hog Industry,* ISPRS Int. J. Geo-Inf. 2015, 4, 150-171; doi:10.3390/ijgi4010150 (Published: 26 January 2015)

**Abstract:** Concentrated animal feeding operations (CAFOs) produce large amounts of animal waste, which potentially pollutes air, soil and water and affects human health if not appropriately managed. This study uses meteorological and CAFO data and applies an air pollution dispersion model (CALPUFF) to estimate ammonia concentrations at locations downwind of hog CAFOs and to evaluate the disproportionate exposure of children, elderly, whites and minorities to the pollutant. Ammonia is one of the gases emitted by swine CAFOs and could affect human health. Local indicator of spatial autocorrelation (LISA) analysis uses census block demographic data to identify hot spots where both ammonia concentrations and the number of exposed vulnerable population are high. We limit our analysis to one watershed in North Carolina and compare environmental justice issues between 2000 and 2010. Our results show that the average ammonia concentrations in hot spots for 2000 and 2010 were 2.5–3-times higher than the average concentration in the entire watershed. The number of people living in the areas where ammonia concentrations exceeded the minimal risk level was 3647 people in 2000 and 3360 people in 2010. We recommend using air pollution dispersion models in future environmental justice studies to assess the impacts of the CAFOs and to address concerns regarding the health and quality of life of vulnerable populations.

Donham KJ1, Lee JA, Thu K, Reynolds SJ., *Assessment of air quality at neighbor residences in the vicinity of swine production facilities*., J Agromedicine. 2006;11(3-4):15-24. doi: 10.1300/J096v11n03_03. http://www.ncbi.nlm.nih.gov/pubmed/19274894

**Abstract:** Air sampling was completed on the front lawn of 35 homes neighboring swine farms in three different regions in the Upper Midwest of the United States. One region was dominated by large scale, swine confined animal feeding operations (CAFO's) noted as swine confinement area (SCA). The second area was dominated by smaller scale operations utilizing hoop structure facilities (HA). The third area was basically devoid of livestock, dominated by row-crop production, and served as the control area (CA). The time weighted average concentrations of hydrogen sulfide (8.42 ppb) was higher ($p = 0.047$) in SCA area than the control (3.48 ppb). However, carbon dioxide (449.6 ppm), ammonia (12.78 ppb) and PM10 (42.25 microg/m3) were higher in the hoop structure area than the other areas. Swine population density, distance between the homes and swine facilities, and wind direction had an interactive effect on the average levels of ammonia ($p = 0.04$). The contaminant levels at the homes were relatively low compared to typical concentrations inside animal buildings. However, exceedences of federal recommended limits for hydrogen sulfide in outdoor air were observed in the swine CAFO area. Concentration of hydrogen sulfide exceeded the recommended limits of the ATSDR (30 ppb) for chronic exposure at two of the 12 homes in the CAFO area (17%). Average hydrogen sulfide concentration exceeded the EPA recommended community standards (0.7 ppb) in all three areas assessed (SCA, HA, and CA). As chronic exposure to hydrogen sulfide may be present in areas of production agriculture, a potential health risk may be present. Further studies to provide additional information regarding exposures to hydrogen sulfide in rural environments are warranted.

Thorne PS, Ansley AC, Perry SS. *Concentrations of bioaerosols, odors, and hydrogen sulfide inside and downwind from two types of swine livestock operations*. J Occup Environ Hyg. 2009 Apr;6(4):211-20. doi: 10.1080/15459620902729184 http://www.ncbi.nlm.nih.gov/pubmed/19177273

**Abstract:** Few data on in-barn and downwind concentrations of endotoxin, bioaerosols, and odors from livestock facilities are available, and no studies have compared conventional confinement operations with the more animal-friendly hoop operations. Hoops are open to the environment and use a composted bedding system rather than housing pigs on slatted floors over pits holding manure slurry as in conventional confinements. We assessed airborne toxicants upwind, in barns, and downwind and evaluated determinants of exposure. Inhalable particulate matter, endotoxin, odor threshold, hydrogen sulfide, culturable mesophilic bacteria, culturable fungi, and total airborne microbes, along with wind speed, temperature, and humidity were measured at separate midsized livestock facilities (one hoop, one confinement) in Central Iowa on 10 occasions over 2 years. Significant differences in contaminants were observed between hoops and confinement buildings and across seasons for endotoxin, odors, airborne microorganisms, and hydrogen sulfide. For hoops and confinements, respectively, geometric mean in-barn concentrations were 3250 and 3100 EU/m(3) for endotoxin; 1400 and 1910

microg/m(3) for particulates; 19.6 and 146 ppb for hydrogen sulfide; 137 and 428 dilutions for odor threshold; and 3.0 x 10(6) and 1.5 x 10(6) organisms/m(3) for total microbes. Endotoxin, odor, and culturable microorganisms exceeded recommended exposure limits. Reduced analysis of variance models for these contaminants demonstrated differences by barn type, season, number of pigs, and, in some cases, temperature and humidity. Both types of swine operations produced high airborne concentrations of endotoxin, odor, hydrogen sulfide, bacteria, and fungi. Endotoxin and odors were found downwind at concentrations previously associated with adverse health effects.

## Others

**Studies submitted as Exhibits**

Dana Cole et al., *Concentrated Swine Feeding Operations and Public Health: A Review of Occupational and Community Health Effects*, 108 Envtl. Health Perspectives 685 (2000), *available at* http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1638284/pdf/envhper00309-0041.pdf, attached as **Exhibit 39.**

Carrie Hribar, Nat'l Ass'n of Local Bds. of Health, *Understanding Concentrated Animal Feeding Operations and Their Impact on Communities, Environmental Health* 4 (2010), *available at* http://www.cdc.gov/nceh/ehs/docs/understanding_cafos_nalboh.pdf, attached as **Exhibit 40**.

Pew Commission on Industrial Farm Animal Production, Environmental Impact of Industrial Farm Animal Production 1-2 (2008), *available at* http://www.ncifap.org/_images/212-4_EnvImpact_tc_Final.pdf, attached as **Exhibit 45** [hereinafter, Pew, Environmental Impact] (same).

Pew Commission on Industrial Farm Animal Production, Putting Meat on the Table: Industrial Farm Animal Production in America (2008), *available at* http://www.ncifap.org/_images/PCIFAPSmry.pdf, attached as **Exhibit 46** [hereinafter, Pew, Putting Meat on the Table] (describing the rise of industrial animal production in America and the effects on public health and the environment).

**Cited in Complaint, but copy not provided.**

Joan A. Casey, *High-Density Livestock Operations, Crop Field Application of Manure, and Risk of Community-Associated Methicillin-Resistant* Staphylococcus aureus *Infection in Pennsylvania*, 173 J. Am. Med Ass'n: Internal Med. 1980 (2013).

Ctrs. for Disease Control, U.S. Dep't of Health and Human Servs., Antibiotic Resistance Threats in the United States, 2013, at 6 (2013), *available at* http://www.cdc.gov/drugresistance/threat-report-2013/pdf/ar-threats-2013-508.pdf.

Oliver Denis et al., *Methicillin-Resistant* Staphylococcus aureus *ST398 in Swine Farm Personnel, Belgium*, 15 Emerging Infectious Diseases 1098 (2009) (Belgium).

*B. Edwards B & AE Ladd, *Race, Poverty, Political Capacity and the Spatial Distribution of Swine Waste in North Carolina*, 1982–1997, 9 North Carolina Geogr 55–77 (2001).

Michael Greger & Gowri Koneswaran, *The Public Health Impacts of Concentrated Animal Feeding Operations on Local Communities*, 33 Farm Cmty. Health 11, 13 (2010).

Joseph Herriges et al., *Living with Hogs in Iowa: The Impact of Livestock Facilities on Rural Residential Property Values*, 81 Land Econ. 530 (2005).

Xander W. Huijsdens et al., *Community-Acquired MRSA and Pig-Farming*, 5 Annals Clinical Microbiol. & Antimicrobials 26 (2006) (Netherlands).

T. Khanna et al., *Methicillin Resistant* Staphylococcus aureus *Colonization in Pigs and Pig Farmers*, 128 J. Veterinary Microbiol. 298 (2008) (Canada).

Jungik Kim & Peter Goldsmith, *A Spatial Hedonic Approach to Assess the Impact of Swine Production on Residential Property Values*, 42 Envtl & Res. Econ. 509 (2009) (estimating decline in Craven County home property values on per hog basis).

Katherine Milla et al., *Evaluating the Effect of Proximity to Hog Farms on Residential Property Values: A GIS-Based Hedonic Model Approach*, 17 URISA J. 27 (2005) (finding that values of Craven County, North Carolina homes decreased with increasing local hog populations and decreasing distances from homes to factory farms).

*Jessica L. Rinsky et al., *Livestock-Associated Methicillin and Multidrug Resistant* Staphylococcus aureus *Is Present Among Industrial, Not Antibiotic-Free Livestock Operation Workers in North Carolina*, 8 PLoS One e67641 (2013).

Jochen Schulz et al., *Longitudinal Study of the Contamination of Air and of Soil Surfaces in the Vicinity of Pig Barns by Livestock-Associated Methicillin-Resistant* Staphylococcus aureus, 78 Applied Envtl. Microbiol. 5666 (2012) (detecting MRSA 300 feet from a barn in which animals, air, and workers' plastic boots tested positive for MRSA).

Doug Gurian-Sherman, Union of Concerned Scientists, CAFOs Uncovered: The Untold Costs of Confined Animal Feeding Operations (2008), *available at* http://www.ucsusa.org/assets/documents/food_and_agriculture/cafos-uncovered.pdf (discussing the substantial cost of confined animal feeding operations and discussing alternatives).

EK Silbergeld & LB Price LB, *Industrial Food Animal Production, Antimicrobial Resistance, and Human Health*, 29 Ann. Rev. of Pub. Health 151 (2008).

Tara C. Smith et al., *Methicillin-Resistant* Staphylococcus auereus *(MRSA) Strain ST398 Is Present in Midwestern U.S. Swine and Swine Workers*, 4 PLoS One e4258 (2009).

Tara C. Smith et al., *Methicillin-Resistant* Staphylococcus aureus *in Pigs and Farm Workers on Conventional and Antibiotic-Free Swine Farms in the USA*, 8 PLoS One e63704 (2013).

Stacy Sneeringer, *Does Animal Feeding Operation Pollution Hurt Public Health? A National Longitudinal Study of Health Externalities Identified by Geographic Shifts in Livestock Production*, 91 Am. J. Agric. Econ. 124, 130 (2009).

*Paul B. Stretesky et al., *Environmental Inequity: An Analysis of Large-Scale Hog Operations in 17 States, 1982-1997*, 68 Rural Soc. 231 (2003) (finding that between 1982 and 1997 large-scale hog operations in North Carolina were more likely to be sited in areas with a disproportionate number of black residents).

K.M. Thu, *Public Health Concerns for Neighbors of Large-Scale Swine Production Operations*, 8 J. Agric. Safety & Health 175 (2002) (synthesizing research regarding public health concerns for neighbors of industrial swine facilities, including respiratory issues associated with air pollution).

Ingrid V.F. Van den Broek et al., *Methicillin-Resistant* Staphylococcus aureus *in People Living and Working in Pig Farms*, 137 J. Epidem. & Infection 700 (2009) (Netherlands).

Wing S. 2002. *Social Responsibility and Research Ethics in Community-Driven Studies of Industrialized Hog Production. Environ.* Health Perspect. 110:437–444.

**Studies not listed above but cited in Exhibit 4 (**Steve Wing & Jill Johnston, Dep't of Epidemiology, Univ. of N.C. at Chapel Hill, *Industrial Hog Operations in North Carolina Disproportionately Impact People of Color* (2014)).

*Bullers S. 2005. *Environmental Stressors, Perceived Control, and Health: The Case of Residents Near Large-Scale Hog Farms in Eastern North Carolina*. Human Ecology 33:1-16.

Casey JA, Curriero FC, Cosgrove SE, Nachman KE, Schwartz BS. 2013. *High-Density Livestock Operations, Crop Field Application of Manure, and Risk of Community-Associated Methicillin-Resistant Staphylococcus Aureus Infection in Pennsylvania*. JAMA Internal Medicine 173:1980-1990.

Cole D, Drum DJ, Stalknecht DE, White DG, Lee MD, Ayers S, et al. 2005. *Free-living Canada Geese and Antimicrobial Resistance*. Emerging Infectious Diseases 11:935-938.

Donham KJ. 1990. *Health Effects from Work in Swine Confinement Buildings*. American Journal of Industrial Medicine 17:17-25.

Donham KJ, Wing S, Osterberg D, Flora JL, Hodne C, Thu KM, et al. 2007. *Community Health and Socioeconomic Issues Surrounding Concentrated Animal Feeding Operations*. Environ. Health Perspect. 115:317-320.

Furuseth O. 1997. *Restructuring of Hog Farming in North Carolina: Explosion and Implosion*. Professional Geographer 49:391-403.

Graham JP, Price LB, Evans SL, Graczyk TK, Silbergeld EK. 2009. *Antibiotic Resistant Enterococci and Staphylococci Isolated from Flies Collected near Confined Poultry Feeding Operations*. Sci Total Environ 407:2701-10.

Rinsky JL, Nadimpalli M, Wing S, Hall D, Baron D, Price LB, et al. 2013. *Livestock-Associated Methicillin and Multidrug Resistant Staphylococcus Aureus Is Present Among Industrial, Not Antibiotic-Free Livestock Operation Workers in North Carolina*. PloS One 8:e67641.

Thu K, Donham K, Ziegenhorn R, Reynolds S, Thorne P, Subramanian P, et al. 1997. *A Control Study of the Physical and Mental Health of Residents Living near a Large-Scale Swine Operation*. Journal of Agricultural Safety and Health 3:13-26.

Thu K. 2001. *Agriculture, the Environment, and Sources of State Ideology and Power*. Culture and Agriculture 23:1-7.

Thu K. 2003. *Industrial Agriculture, Democracy, and the Future. In: Beyond Factory Farming: Corporate Hog Barns and the Threat to Public Health, the Evironment, and Rural Communities*, (Ervin A, Holtslander C, Qualman D, Sawa R, eds). Saskatoon, Saskatchewan:Canadian Centre for Policy Alternatives.

van de Giessen AW, van Santen-Verheuvel MG, Hengeveld PD, Bosch T, Broens EM, Reusken CB. 2009. *Occurrence of Methicillin-Resistant Staphylococcus Aureus in Rats Living on Pig Farms*. Preventive Veterinary Medicine 91:270-273.